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HOSPITAL AND LABORATORY[1]

THE formal opening of this hospital and clinic is significant of something of far greater importance than throwing open the doors of a new building which is imposing and beautiful in its architectural details and perfectly adapted in its plan and equipment to the purposes for which it is intended. This occasion signalizes the inauguration of a great experiment, for which the erection of this magnificent building, the installation of the splendid equipment, and the gathering together of the trained men who are to work within its walls represent but the collection of utensils and apparatus to be used in the performance of the test. That such elaborate plans should have been prepared indicates that those who have been responsible for this great undertaking possess a profound and abiding conviction and belief in the probable correctness of the idea, the truth or falsity of which is to be tested. These intrepid innovators believe that that branch of knowledge which has to do with disease in man has reached a stage in its development which entitles it to occupy a dignified and important place in the group of subjects which the university considers its domain. The fund of information concerning disease has grown to a sufficient bulk, the methods devised for its investigation have become sufficiently accurate, the subject itself is of sufficient interest, and its importance in all that relates to human welfare is sufficiently great to justify the prosecution of its study as an aid in the interpretation of nature, and not, as in the past, only as a part of the discipline required for engaging in a practical profession. This idea is not new, it did not originate in the minds of those responsible for this experiment, it did not spring forth fully formed like Minerva from the head of Jove. There have been many preliminary experiments, *Vorversuche,* but here in this relatively young university, which has been the cradle of so many fruitful innovations in the field of education, this idea is to receive a trial with facilities worthy of the importance of the issue.

It is especially appropriate that this experiment should be made in this great institution whose own commencement involved not one, but many experiments. President Harper early spoke of this univer-

[1] Address delivered at the dedication of the Albert Merritt Billings Hospital and the Max Epstein Clinic of the University of Chicago, November 1, 1927.

sity as "an institution in which a score or more of new educational experiments are being tried." You will recall that, from the instant that his interest was aroused in this institution, the idea of a *university* was uppermost in his mind. He could not entertain the notion of the development of another college and his enthusiasm was really only awakened when resources were made available to found an institution which should be not merely a training school, nor even a place where learning and culture should be preserved and fostered, but which should be a workshop in which the boundaries of knowledge should be extended and the innermost secrets of nature be investigated.

It was the natural outcome of its earlier existence that at the new University of Chicago attention should have been given first to those branches of human knowledge which have to do with man's spiritual needs and social relationships. But before the institution opened its doors it was possible to announce that, through the generosity of a great benefactor, there should be established as a part of the university, a school of science, a department in which the world of nature would be studied and investigated. In this department special attention was to be given to the encouragement of research, more emphasis was to be placed on the skill of professors to investigate than on their ability to teach. It is of interest that in this school of science the departments were to be those of physics, chemistry, biology, geology and mineralogy, and astronomy. While under biology may be included the study of the human species, yet, in the past, in departments of biology, the study has usually included all living things except man. The study of the structure and functions of the human body has been held to be the prerogative of those undertaking a special vocation or profession. An educated man should know something about physics and chemistry; he needs to know *nothing* about human anatomy or physiology. Indeed it has been considered not quite natural or proper for him to want to know, unless he is to use this knowledge practically. Those were not subjects for general culture. They belonged in the technical school which might, or might not, be affiliated with the university, but they were not real, integral members of the group of university branches of study. In the investigation of natural phenomena, the inquiry as to the nature of man has come relatively late. Astronomy long preceded anatomy. Possibly the reason was a realization of the difficulties of this investigation; more likely there has been a fear of uncovering secrets that have seemed almost sacred.

Very early, however, this university recognized that human anatomy and human physiology thrive best when each can have an independent existence, free from the restraints imposed by the exclusive preparation of students for the practice of medicine. Housed in buildings on the university campus, adjacent to the departments of physics, chemistry and the other branches of natural science, these departments were incorporated as true university departments in the Ogden School of Science, and they have grown to occupy important and dignified positions. The facilities of these departments have been open to all who were prepared to profit by the opportunities offered. It is true that most of the students have expected to engage in the practice of medicine, but the fact that these departments have functioned as university departments, in which a foremost place has been given to the extension of knowledge, has been an important factor in determining the high quality of the work which they have accomplished.

The study of the abnormal, the unusual, in the structure and function of man has, however, until now not been undertaken in the same way. For many years all who have been interested in medical education have desired to see this university wholeheartedly enter this field. Years ago Mr. Gates, the great supporter and promoter of all that is good in this university, wrote, "this conception, has been one of the dreams of my own mind, at least, of a medical college . . . , magnificently endowed, devoted primarily to investigation, making practice itself an incident of investigation, and taking as students only the choicest spirits." In this statement Mr. Gates gave expression to the age-old view that it is necessary to combine all that which relates to the study of the structure and function of man, in health and in disease, in one department, a department of medicine, or, as he inadvertently said, a "college," a term which, used in connection with higher education, was anathema to President Harper. The delay in the incorporation of a "college of medicine" within this university, therefore, may have been for good. It has permitted the independent foundation of the departments of physiology and anatomy and it now permits the experiment of establishing within the university a true university department of medicine, or better, a department of pathology in the broadest use of the term, which includes not only the study of disease but also the investigation of methods for its prevention and eradication.

When President Burton took up the duties which had to be relinquished by President Judson, the idea of a university department of medicine found fertile soil. His long experience in teaching and investigation made him enthusiastic regarding this point of view. In a conversation with him concerning this matter, I well remember his saying, in substance, "I

know little about medical education but I have had a long experience in theological schools. It was only when we gave up training men to preach and began to assist them in the study of theology that we began to have results commensurate with our efforts, not only in developing scholars, but in producing worthy ministers of the Gospel as well." It was only natural, therefore, that under the guidance of this man the determination to test the effectiveness of this conception should have been made, and under him and President Mason and Professor McLean all the preparations for the experiment have been carried out.

It is unnecessary to speak to this audience of the practical importance of the study of disease or to recall the results which have already been attained in the relief of suffering and the prolongation of human life, through the acquisition of knowledge concerning this great impediment to the enjoyment of happiness and obstacle to human welfare. As a result of increased knowledge, uninhabitable parts of the world have been made pleasant, many infectious diseases, such as yellow fever, have been all but eradicated, the occurrence of diseases like typhoid fever has been markedly diminished, severe diseases, such as diphtheria, have been made almost harmless, and the effects of certain widespread and distressing maladies, such as diabetes, have been extraordinarily reduced. These are but a few of the beneficent results flowing directly from the increase in knowledge concerning disease. The possibilities of blessing to come are enormously greater. That all infectious diseases can be prevented or eradicated is not beyond the bounds of possibility. What would a contemporary of Queen Elizabeth have said if he had been told that in three hundred years in a city many times the size of London not a pock-marked face would be seen on the streets, not a soul would suffer the annoyance of the itch, and that most of the population would never have heard of the plague.

But ignorance concerning disease is still appalling. One who has never stood by the bedside of a loved one dying of disease, conscious that his efforts are rendered useless solely through ignorance, which in the present state of the basic sciences might be removed, has never tasted the bitterness of grief. Preventable disease and misery are still with us. Present knowledge was not able to prevent in 1918 the spread of a disease which swept over the entire world and in the course of a few months was responsible for the deaths of over half a million people in this country or five times the number of our soldiers that lost their lives in the war. It is estimated that in India 6,000,000 people died during the visitation of this epidemic. Let us not only say, let there be no more war, but let us also say, let there be no more epidemics.

Probably even still more important than the practical results in the prevention and cure of disease are the possible effects which the study of disease may have on prevailing biological theories and laws. It has not infrequently happened that the unusual and bizarre in nature have stimulated man's imagination and have led him to undertake investigations which have finally resulted in the formulation of general laws. Observation of the rainbow led to important discoveries in the field of optics, observation of lightning directed man's attention to the study of electricity.

The investigation of all biological phenomena is attended with great difficulty. During the past century great progress has been made, yet it can not be held that the formulation of any laws or generalizations regarding biological phenomena has been comparable in significance with the discovery of the laws regarding gravitation, the conservation of matter or the laws of thermodynamics. The methods to be employed in the investigation of biological phenomena are in principle the same as those which have been so productive in investigation in other branches of science, the results of which have been to give man that marvelous control over the forces of nature, the blessings of which we enjoy but hardly appreciate. Man tried for a thousand years to learn about his environment solely by exercising his reasoning powers, and the result was the dark ages. But in the seventeenth century there was introduced into his armamentarium a new weapon, a new method, the method of experiment. Man began to observe, to think, to try. Before he had only thought. The past three hundred years may be set apart from all that preceded as the Age of Experiment. What is called the scientific method has almost banished darkness from the earth, has almost annihilated distance and has lengthened time.

There have been many attempts to analyze the scientific method, though usually not by scientists themselves, for as one scientist has said, too great self-consciousness might make him lose his power "like the famous centipede, who after profound analysis of his own method of locomotion, found he could not walk." In the scientific method there are undoubtedly three kinds of activity always engaged in, seeing, thinking and doing. But probably rarely, and then only in the simplest cases, are these employed in strict succession. In profitable investigation the observer thinks and the thinker observes. The hypothesis, as we say, frames itself and the trial is made. No question, however, is ever settled by one experiment. The experiment must be repeated, the conditions changed, new observations made, thinking and reasoning going on all the time, until there emerges the answer to the question.

Certain students of the nature of science itself have attempted to classify the various branches of science, and have called certain ones, such as physics and chemistry, in which accurate measurements are important and in which the abstractions of mathematics are largely employed in interpreting results, the exact sciences and have called those branches of science in which, for the present at least, accurate measurements are not so important, the descriptive sciences. All science however is descriptive. Science is an attempt to describe natural phenomena in comprehensible terms. Certain it is that the greater the number of generalizations which are true, or at least seem to be true, for a large class of reactions, the more simple and understandable the subject becomes, and the more these laws can be reduced to mathematical exactness the more useful they are. But we are in possession of a vast store of knowledge which has been of the greatest benefit to mankind, but to which, at present, the methods of quantitative measurement are not applicable. There has even been an attempt to deny the value of all investigation that is not strictly quantitative in its methods. The statement has been made that investigation only becomes scientific when it becomes quantitative. This seems to me to be a narrow point of view which partakes somewhat of intellectual snobbishness. This attitude, however, is not universal; it is even rejected by many whose own methods are the most exact and quantitative. Professor Gilbert Lewis has recently said, "I have no patience with attempts to identify science with measurement, which is but one of its tools, or with any definition of the scientist which would exclude a Darwin, a Pasteur, or a Kekulé." One may add a Harvey, a Mendel, a Virchow and many others. Another writer states, "It savours of what we may call scientific Chauvinism to maintain that the physico-chemical interpretations, when they go to the formation of our outlook on nature, require no correction from the biological, mental and social sciences. It requires a long-necked observer to see the whole firmament out of one window." That biology is not as exact as physics or chemistry is related in part to the fact that the phenomena studied do not occur in a simple system; the complexity of the environment in which these phenomena take place, even in the simplest unicellular organism, seems bewildering. Moreover, compared with astronomy and physics, biology is a young science, and only in very recent years has the experimental method been seriously applied to the solution of its problems.

Another point of view which seems to me misleading is the frequent reference to medical science as an applied science. In this designation the assumption is made that it is "oriented in relation to the art of healing." It is true that this has largely been the case in the past and this, I feel, is one of the reasons why even greater progress has not been made in the development of this branch of knowledge. It must be admitted that many of the great discoveries in medicine have been largely empirical. This does not minimize their importance either to science or to humanity. But, in a constantly increasing degree, knowledge in this field is unfolding through the conscious employment of the experimental method, using the discoveries and laws of the basic sciences as stepping stones. It is this that justifies the belief that, in the future, progress in this branch of science will be even more rapid than that which has occurred in recent decades.

Since pathology is a young science, barely in its infancy, accurate observation must of necessity occupy an important part in the activities of its devotees. Indeed, the first step in the study of any science is the observation and description of natural phenomena. Only by this means do we come to have knowledge of what we want to explain. All the sciences, except mathematics, are concrete, in that they deal with what actually happens. There is little point in studying with scientific methods that which "never was on sea or land." It would be my last wish to minimize the importance of the poet, but his ways are not the ways of the scientific observer. Apollo was worshipped not only as the god of medicine, the father of Aesculapius, but also as the god of poetry, music and art, and doctors have always had a propensity to philander with the muses, yet the student of scientific medicine, as the student of every other science, when he is playing the part of an observer, must place a guard over his emotions and, face to face with Nature, must try to see straight. Included in observation is classification, which method has been, and always will be, important in making our observations workable. But accurate observation is not sufficient. "How" and "why" are bound to intrude and must become insistent if knowledge is to grow. In trying to answer these questions the student may now loosen the leash upon his imagination. He may even listen to "the bluebird singing of beautiful and impossible things, of things that are lovely and that never happen, of things that are not and should be." In this stage of the process of discovery the greater the student's power of making unusual and new combinations and the greater his ability to visualize his previous observations in a new light, the more likely is his chance of success. But the scientist and also the physician must keep his reason and his emotions in separate compartments. In selecting which hypothesis he shall try, as he can not try them all, he must again

lock up his imagination and call on reason to aid him. In the light of accumulated knowledge, is this or that hypothesis likely to be the right one? Then comes the doing, the performance of the actual experiment, and again there must be accurate observation, for without this the test will be worthless.

For all these procedures of observation and testing, the student of science, be it physics or medicine, must have a workshop, that is a laboratory. And these workshops to-day must be elaborate and costly affairs. When science was younger and when the chief interest lay in those branches of physics where conditions could be easily controlled, as in the science of mechanics, laboratories belonged to the individual. But, as the sciences developed, more elaborate equipment became necessary and the providing of laboratories became a communal obligation, a function of the state or of the university. To-day the university laboratories, even those of physics, have become elaborate affairs, equipped with powerful engines and motors, as well as with the most delicate and finely adjusted instruments. An air-pump and an inclined plane no longer suffice for the needs of the physicist. This development of university laboratories has occurred with astounding rapidity. Until the early part of the last century the only university laboratories worthy of the name were those of anatomy—laboratories for observation and description. It was only about one hundred years ago that the first university physiological and chemical laboratories were established, that of Purkinje, at Breslau, in 1823, and that of Liebig, at Giessen, in 1824. It was even later, in 1845, that the first university laboratory of physics was established by William Thomson, later Lord Kelvin, at the University of Glasgow. Astronomical laboratories are probably the oldest laboratories of all, for man's first wondering gaze apparently fell upon the heavens, certainly long before he became inquisitive about his fellow man. There is evidence that an observatory existed at Alexandria 300 B. C. Because of the importance of astronomy in navigation, for many years observatories were erected and supported chiefly by the state, though the study of the stars has always been a favorite avocation of the rich and noble and they erected observatories for their own use and that of their scientific protégés. At the end of the eighteenth century, however, observatories began to be established in universities, the Radcliffe Observatory at Oxford, presented by the London physician, John Radcliffe, being founded in 1771. The Harvard Observatory was established only in 1847.

From the time that President Harper accepted the presidency of this university and understood its organization, he emphasized the importance of laboratories. It is not surprising, therefore, that a week after the university began to admit students the announcement was made of a gift which enabled the university to erect and equip the most complete astronomical observatory then existing in the world. With the development of the university there were established in rapid succession the wonderful laboratories that have been the envy of most other institutions of learning.

While it required many years for the universities to recognize the importance of, and to establish, observatories where natural phenomena could be observed and in which experimental studies could be made, it has required a still longer time for the universities to recognize the importance of establishing their own hospitals, that is observatories, where human disease, as it occurs under natural conditions, can be carefully and accurately observed, and also their own laboratories of medicine where experimental studies concerning disease may be conducted. It is true that in Germany many so-called university hospitals exist but in most cases these are but municipal or state institutions, more or less under university control. In this country also certain state hospitals have had a close affiliation with the university, but, so far as I know, this is the first hospital erected on the campus by a university with the analogy of the hospital and laboratory clearly in mind.

In the past there has been a trace of the repugnant in the conception of a hospital as a laboratory. Hospitals were originally founded, as the name indicates, to provide hospitality to the poor and decrepit; only later did they become institutions for the care and treatment of the sick. Our most tender and gentle emotions are connected with the idea of ministering unto those suffering from disease. To expose our loved ones to the gaze, and especially the inquisitive gaze, of strangers has seemed cruel and harsh. It is unnecessary here to dwell on the change which has taken place within recent years in the attitude of the public toward the hospital. With the development and growth of modern scientific medicine and with the general recognition of the great blessings which it has bestowed, the dread of entering hospitals and the reluctance to send our friends into them have largely disappeared. The rich, as well as the poor, the powerful and influential, as well as the weak and obscure, are rushing to fill our hospital beds, until society has become unable to supply the demands. Moreover, it has come to be recognized that the best care will be obtained where the observation of patients is the most painstaking and accurate. There is, therefore, no longer any reason why the hospital should not be spoken of as an observatory in which

the sick are observed, studied and treated. The hospital is the observatory of the department of medicine. It, of course, must also continue to be the dispenser of hospitality, and it would be a sad day for both scientific and practical medicine if this were ever forgotten. Observation must include not only seeing the sick with our naked eyes, it must be done with the aid, not of powerful telescopes and lenses, but with all the instruments of precision which the other sciences have furnished.

Even this, however, is not sufficient for the university department of medicine if it is to perform its proper function. The student of disease must be constantly seeking for new knowledge that can not be obtained by observation alone. He must employ the other steps in the method of experimentation. This does not mean that patients must be the subjects for experiment—far from it. In my experience the application of new and untried measures to patients in any hospital is in inverse ratio to the scientific atmosphere there existing. It is only in hospitals directed by the ignorant and by charlatans that unusual and untested measures are employed. Indeed, one important purpose of the experimental laboratory is to make certain that any measures to be applied to patients will be helpful and not harmful. The scientific observer of disease does no more harm to his patient than the astronomer does to the stars when he directs his gaze upon them through the telescope. When necessary, experimental studies must be made on animals, under proper conditions to avoid unnecessary pain. But in most of the experimental work in the laboratory of medicine the materials used are not animals, but they are bacteria and excretory fluids, and the instruments used are not knives and trephines, but microscopes and chemical reagents. It is this very inability to modify conditions in his field of observation that makes the work of the student of disease so difficult, just as it does that of the astronomer. The student of disease, as the student in the other branches of biological science, must bring to his aid the methods of the more fundamental sciences, physics and chemistry and physical chemistry, and even employ the methods of mathematics. There can be no doubt concerning the importance of the application of the methods and the contents of these sciences in the study of disease, but in these days of rapid progress we must be on our guard not to be over-fascinated by the prospect which the mere application of the methods of these sciences holds forth. We shall do well to remember the fate of the iatro-chemical and the iatro-physical schools of medicine which flourished in the seventeenth century, in another period of great activity in the physical sciences. The chief result of the foolish pretensions of these schools was the cry "Back to Hippocrates" and a turning of the doctors to Sydenham for guidance. We should remember that, while the contributions of Borelli and van Helmont have had no permanent influence on medical progress, Sydenham is still a living force. Newer concepts like that of emergent evolution give some support to the biologists who hold that there is something more in biological phenomena than the mere manifestations of energy working according to the laws of physics and chemistry that are already known. We sometimes forget that very few of these so-called laws have been discovered and that they are but imperfectly understood. Moreover, our faith in the immutability of some of the most cherished ones has recently been rudely disturbed. An important scientist, Whitehead, has recently said, "Science is taking on a new aspect which is neither purely physical, nor purely biological. It is becoming the study of organisms. Biology is the study of the larger organisms, whereas physics is the study of the smaller organisms." Furthermore, he says, "no one doubts that in some sense living things are different from lifeless things." Let us as biologists and as students of disease be not too modest, ashamed of our problems and our methods. Above all, let us not forget that we have our own problems. Progress is never made by waiting for an explanation of all the details before going ahead. Columbus did not wait for a map of the ocean currents, nor did Lindbergh wait for a chart of those of the air.

In the department of medicine the student should never forget that he is studying disease. In order to make progress he may need to go far afield, since the other sciences may not furnish him the methods or the necessary knowledge to make the next step, but the main problem should always be in the background of his consciousness. Otherwise he would probably better be working in the laboratory of physics or chemistry or physiology. None of those working in the domain of science may stake out preserves. Each worker is bound to be led into his neighbor's field and it is in these wanderings that the best game is usually bagged. But each one, and especially the worker in the department of medicine, should always remember where his home lies. He can never forget this if he has contact with patients in the hospital. He must not forget it if the university department of medicine is to justify its existence.

It is obvious that in the organization and equipment of a department of medicine, the university is confronted with an enormous task, not only in supplying the material resources needed for the hospital and various laboratories but in obtaining men who

are properly equipped for the work to be done. In some places the attempt has been made to avoid some of the difficulties by divorcing experiment from observation, by establishing a department of experimental medicine separate from the department of clinical medicine in which study can be made only by means of observation. That progress can be made by observation alone, the history of science abundantly indicates. Hypothesis may follow observation and confirmation or rejection of the hypothesis may come through repeated observations. Indeed, with a sufficient number of observations, possibly even general laws might be deduced without the formulation of any hypothesis whatever. But that has not been the history of scientific advancement. Observation alone makes the road to knowledge long and tedious. The introduction of experimentation provided the needed short cut. On the other hand, many of the advances in recent years have been made by men whose only contact with human disease has been through their own afflictions. The importance of the contributions to our knowledge of disease made by physiologists, by chemists, by physicists, and by those working with disease experimentally induced in animals has been enormous and it is hoped and believed that these contributions will be continued in ever-increasing number. However, the complete separation of the observation of disease, as it occurs naturally, from the more intensive and experimental study seems neither rational nor advisable. It is impossible to reproduce human diseases accurately in animals. Conditions very like those occurring naturally in man may be produced in animals but there is always a difference, very often an important one. Through contact with human disease the imagination is stimulated, placing various observations in juxtaposition gives rise to new ideas, hypotheses develop. These hypotheses, however, will be of value only if they are not mere vain imaginings but if they can be put to the test by the individual making them. The opportunity for testing stimulates the formulation of ideas, in other words it develops the scientific, the experimental attitude of mind. From the educational standpoint this is most important of all. Many of the students in this department will become practitioners of medicine. Whether engaged in the practice of medicine or in investigation the scientific attitude of mind is essential. If this or any other university can cultivate in its students the desire to learn what is unknown, it will probably have solved the educational problem, provided, of course, the student is willing to spend the time and effort necessary to obtain the training required for fulfilling his desires. If one may paraphrase, "we do but go where *curiosity* leads the way."

But not all the students in this department will become practitioners of medicine. Some will become teachers, others will engage in public health activities, in which a knowledge of disease is of first importance. A few, and probably a constantly increasing number, will engage in the study of disease simply because it is a subject of extraordinary interest and because of its importance in the formulation of general biological principles. Some will become investigators of disease because of their desire to prevent suffering and to promote human welfare. With the accumulation of wealth in this country there will undoubtedly be an ever-increasing number of men and women who are relieved of financial burdens. In the past these men and women have become artists, explorers, writers. What is more fitting in this "Age of Experiment" than that some of these persons should become scientists, and what more interesting field in science can there be than the study of disease? In what way can these men and women be more useful to humanity? The university, however, must see to it that these opportunities are not limited to those financially independent. As Professor Huxley has said, "It is given to the few to add to the store of knowledge, to strike new springs of thought, or to shape new forms of beauty. But so sure as it is that men live not by bread, but by ideas, so sure is it that the future of the world lies in the hands of those who are able to carry the interpretation of nature a step further than their predecessors; so certain is it that the highest function of a university is to seek out these men, cherish them, and give their ability to serve their kind full play."

I congratulate this university that it has had benefactors of such generosity and wisdom as to establish and endow this hospital and clinic and department of medicine. I congratulate these donors for the opportunity which has been granted to them to perform so great a service to learning and to humanity. All that is possible has been done in preparation to provide hospitality and comfort for the sick, to relieve their ailments and to provide for their esthetic and spiritual needs; laboratories and equipment have been supplied so that patients suffering from disease may be studied in order that light may be shed on all that is mysterious and obscure; provision has been made for applying all that is known to relieve pain and distress and to save life; but, more important than all, provision has been made for investigation, so that more may be known concerning disease and its cure. This is not merely the dedication of a new hospital for the people of Chicago, or of the State of Illinois. It is a world institution; its influence will be felt wherever sickness and suffering exist. Other hospitals and other institutions have made advances

in this direction. The University of Chicago has consciously inaugurated a new idea; it has established a true university department of medicine; it has erected an observatory and laboratory for the study of disease.

RUFUS COLE

HOSPITAL OF THE
ROCKEFELLER INSTITUTE,
NEW YORK CITY

THE BIOLOGY OF LAKE BAIKAL

MY wife and I have just returned to Irkutsk from a most interesting trip to Lake Baikal and Archan. We went first to the Biological Station of the University of Irkutsk, on the shore of the lake, some distance north of the village of Listvenitschnoe. It was our good fortune to be accompanied by Mr. W. Jasnitsky, of the botanical department of the university, who is working at the station and has charge of its affairs at the present time. Leaving Irkutsk, we went on the train to Baikal, a station at the beginning of the great and swift Angara River, which flows out of the lake. Taking the ferry across the Angara we were met by a boat in which we were rowed to the station, a journey of several hours. It was after dark when we saw a faint light across the waters, and presently came to a log house with several rooms, in which teachers and students live, and the work is carried on. Although the resources of the station are pitifully small, and would be considered quite inadequate in most countries, the group working there is a happy one and is doing work of great value. The surroundings are charming, with meadows full of flowers and hills covered with trees in the background. Across the lake at a distance of 40 or 50 kilom., but seeming much nearer, are the great Transbaikal Mountains. The water of the lake is usually calm in morning and evening, but more or less disturbed during the middle of the day. Occasionally there are storms so severe that it is impossible to land from a boat. The principal work going on at the time of our visit was that of W. Jasnitsky on algae and plankton; M. M. Kojoff on the Baikal fauna and especially the spermatogenesis of the snail *Benedictia baicalensis*; Ivan Rubtzoff on planarians, of which he has discovered several new species, one of which is oviparous; W. W. Jzossimoff (of Kazan University) on general hydrobiology, and especially oligochaetes and water-mites; Nina A. Epoff on the flowering plants of the vicinity; N. M. Wlassenko on the parasitic worms of fishes; Galia A. Muromoffa (University of Tomsk) on the plankton of littoral zone; Lidia A. Wasilewskaia on the plants of a defined area. In addition to these, a house close by is occupied by Professor Dorogostaiski, who has charge of the establishment for breeding useful native animals, deer, foxes, sables, squirrels, etc. Some of the foxes are Siberian, others from Alaska. The deer are from the Maritime Province, and were only recently received. The professor is an all round zoologist and has published a very important work on the amphipod crustacea of the lake. He showed me the exquisite colored drawings for a new paper on the amphipods, with many new species, to be published by the Academy of Sciences at Leningrad next year. In spite of the limited resources, there are enough facilities for good work and the good fellowship and romantic surroundings give the place an indescribable charm, accentuated by the sense of peace and remoteness from the troubles of the world. It is an unfortunate circumstance that the authors of the resulting papers have to pay about half the cost of printing, except in the case of specially interesting work, when assistance may be obtained from Moscow, or of course in the rare case of papers published by the Academy of Sciences at Leningrad.

Leaving the university station, we next visited the establishment of the Russian Academy of Sciences, situated at Maritue, south or rather east of the Angara. We were very fortunate in finding there Professor Nassonov, whom I was especially pleased to meet, as I used to correspond with him about Coccidae in the days before the war. Professor Nassonov explained that the house at Maritue was not to be regarded as a biological station, but only as a base for the Baikal expeditions sent out by the Academy. At the moment there were three parties working in North Baikal—a botanical one under Professor Mayer; one on fish and fish breeding, and chemical analysis of water, under Professor Soldatoff; and the third on general zoology, but principally Cladocera, under Verschagen. They have a motor boat, which enables them to reach distant parts of the lake. Nassonov himself had just returned from an expedition and was about to leave for Leningrad. He gave me some very fine and large amphipods, which I shall send to the U. S. National Museum, as Miss Rathbun tells me they have none of the Baikal crustacea. The Academy has in view the establishment of a larger and permanent station, at Tanhos or Mysovsk, preferably the latter because of the great depth of water nearby. Both are on the transsiberian railway, as is Maritue.

The more we study the Baikal problem, the more evident does it become that it includes matters of the greatest interest for biological theory. In spite of the unexplained presence of the seals (*Phoca foetida sibirica* Gmelin), which are said to be nearest related to the Caspian form, the marine elements which figure so largely in many discussions are evanescent. The nudibranch, the pteropod and the nemertean

are doubtful and can not be confirmed. The nudibranch was found in a bottle labeled Baikal, but probably never came from the lake, as no traces of it can be found at the present time. The large sponge *Veluspa baicalensis,* which I found washed up on the shore and also saw dredged, is suggestive of marine relationships. The copepod *Harpacticella* and the amphipod *Gammaracanthus* are also cited in the same connection. The seal does not help the theory of marine origin, as such origin must date far back of the evolution of the species *Phoca foetida,* or indeed presumably of the genus Phoca. Supposing there to have been connection with the sea, some have imagined it to be by way of the Caspian, others have suggested the Arctic Ocean. Professor Nassonov thinks rather that the Sea of Japan holds the key to the understanding of the origin of Baikal. He has found a new genus of Rhabdocoelida, with several species in Lake Baikal, and a marine species on the coast of the Maritime Province, not far north of Korea. Professor Dorogostaiski, I understand, believes that whatever may have been the origin of the lake, its fauna was at a remote period reduced to a few species, and when conditions became favorable these evolved into many, in the absence of competition. Thus the case would parallel that of the Hawaiian Islands, which were populated by a small number of insect and mollusc types, accidentally carried over sea. These groups have in the islands given rise to vast numbers of species, so that while the genera are few, the species are very many. On continental areas the potential species-making ability of a genus can not be realized, most of the possible forms being cut off in the struggle for existence. There are good reasons for thinking that the parallel here suggested is not fanciful, and thus the Baikal biota acquires a new interest. This phenomenon of species-multiplication is probably connected with mutations or changes in chromosome numbers. It will be of extraordinary interest to study the chromosomes of the amphipods, planarians, etc., and see if they exhibit the phenomena of polyploidy.

Baikal appears to be the deepest lake in the world, with a maximum depth of about 1,560 meters. The water is very cold, and saturated with oxygen, the oxygen content being even greater than that of the small streams flowing into it. The water is fresh, with very little mineral matter in solution, and as a consequence the shells of the mollusca are very thin. Thus the conditions are quite unique, and it is not surprising that the fauna is peculiar. When I went down to the shore I expected to see some of the peculiar water-snails, but there are none along the water's edge, where snails would be expected in other places. A little later the dredge was used in a few fathoms, and many snails, planarians and amphipods were brought up. It was very interesting to see *Benedictia baicalensis* alive; the head, tentacles and body above black, but the sole grey. When the dredge brings up such a variety of molluscs, planarians, etc., all attached to the same stones, one gets the impression that species-formation has gone on without diversification of conditions and special adaptations. Nevertheless, there are many species showing special adaptations. Thus the snails of the genus *Benedictia* present a series of species at various depths, those of the lowest zone (*B. fragilis*) being very large, with very thin shells. Similarly the deep-water amphipods show special characters, as pale coloration and long appendages. Some of the deep water amphipods come to the surface at night, and while I was at the station I saw a living *Macrohectopus branickii* (Dybowski), a very translucent species, taken in the plankton the night before. It regularly inhabits a depth of 300 meters. The fauna of the lake includes the following: Mammalia, the seal, of an endemic subspecies; fishes, about 34 species, with an endemic family, and seven genera and 17 species endemic; gammarid crustacea, over 300 species now known, and new ones still being found, all endemic except the common *Gammarus pulex*; Branchiopoda, 12, not endemic; Copepoda, 11 recorded, a few endemic, these and other small crustacea not yet well known; Gastropod mollusca, about 75 species, of which 68 endemic, with several endemic genera, and the family Baicaliidae; Lamellibranch mollusca, 15 species, of which 13 endemic; Planarian worms, over 100 species now known, all endemic (only about 50 species in all Europe!), new ones constantly found; Oligochaetes, over 30, nearly all endemic, with five endemic genera; Rhabdocoelida, shortly to be described by Professor Nassonov, who tells me that all the species of Baikal are positively heliotropic, while all those of other lakes are negatively heliotropic; efforts were made on a small scale to transfer the animals to other waters, but they died; *Gordius* (a specimen was brought in while I was talking to Professor Nassonov; he said it was the first record for Baikal); Bryozoa, three recorded, one endemic; sponges, 10, of which eight endemic and one endemic genus; Protozoa, not yet fully investigated, but proving extremely interesting. Professor Swartschewski, of Irkutsk, has been working on the suctoria commensal on amphipods, and in about three months has found about 50 peculiar species. At Maritue I met Miss Z. I. Senilova, of Moscow, who was working on the Infusoria. She mentioned the peculiar fact that Baikal was now full of a probably new species, which last year she could not find at all. The recorded Rhizopods are ordinary, but Professor Sche-

wiakoff, of Irkutsk, has taken up the study of this group, and important results may be confidently expected. The Tardigrade genus *Macrobiotus* occurs in the lake. The recorded algae are numerous, about 170 species, including a number of endemic *Draparnaldia*. A microscopic alga parasitic on mosquito larvae was described last year by Jasnitski. There is a recently described endemic *Hydra*.

The biota of the region around the lake is purely Palaearctic. The flowering plants include such genera as *Rhododendron, Cotoneaster, Rosa, Rubus, Pedicularis, Parnassia, Papaver, Aconitum, Polemonium, Spiraea, Alnus, Polygala, Scutellaria, Lamium, Ranunculus, Veratrum, Silene, Myosotis, Zygadenus, Geranium, Thalictrum, Chrysanthemum, Linaria, Centaurea, Sedum, Agrimonia, Stellaria, Campanula*, etc. *Potentilla fruticosa* and *Epilobium angustifolium* are abundant, and quite the same as we get in America. A common tall labiate with pink flowers is *Phlomis tuberosa*; I found also a form *albiflora*, with pure white flowers. Land snails are very few in all this region; the only peculiar one I found is apparently the *Eulota asiatica* Dybowski, described as a variety of the European *E. fruticum*. The scarcity of snails may be due to the fact that after the ice age no migration was possible from the south, the Gobi desert intervening.

T. D. A. COCKERELL
GEOLOGICAL COMMITTEE, IRKUTSK, SIBERIA,
AUGUST 17

SCIENTIFIC EVENTS

MEMORIAL OF PROFESSOR BRUCE FINK

THE committee of the university senate of Miami University, appointed by President Brandon to prepare a statement for the senate record in memory of Professor Bruce Fink, submits the following:

Early on the morning of July 10, 1927, Professor Fink died just after entering his laboratory.

He was born in the village of Blackberry, Illinois, December 22, 1861. He was graduated from the University of Illinois in 1887, and received the degree of M.S. in 1894. He continued his graduate work at Harvard University as a Townsend scholar, where the degree of A.M. was conferred upon him in 1896. His work was completed for a doctorate at the University of Minnesota in 1899. He studied at the University of Chicago in 1903. From 1887–92 he was engaged in secondary education; from 1892–1903, professor of biology in Upper Iowa University; from 1903–06, professor of botany, Grinnell College, and from 1906 to the time of his death, professor of botany, Miami University.

A partial list of his activities outside of the immediate conduct of his department indicates his wide general interest in promoting botanical research and something of his standing among his fellow botanists. He took part in a botanical survey of Minnesota, 1896–03; was in charge of botanical studies at the Marine Biological Station, Puget Sound, Washington, 1906, and was associate editor of *Mycologia* from 1908 on. He was a fellow of the American Association for the Advancement of Science; member of the American Society of Naturalists, of Botanical Society of America, of the Botanical Society of the Central States, the Sullivant Moss Society president, 1910. His leadership in scientific circles was recognized by becoming president of Iowa Academy of Science in 1904, and of the Ohio Academy of Science in 1912.

His productive work as a scientist is indicated by the long list of titles of his publications—more than one hundred, mainly relating to lichens. During his study of these plants he amassed a large collection of some 15,000 specimens, one of the most complete in this country. He was generally recognized as the leading American lichenist and one of the two greatest in the world. At the time of his death he was bringing together the results of his long research in the form of a monograph, "The Lichens of the United States." His work was so far advanced that it will be possible to complete it essentially as he had planned to do himself.

He was much interested in young people and helped them in many ways. He was an especially keen judge of ability in students and was able in many instances to encourage individuals of promise to enter the field of science as a life career. More students went into graduate work from his department than from any other in the university. Among these many have become leaders in various fields of botanical research.

As a citizen he had a high sense of civic responsibility, and was active in many enterprises promoting community welfare or adding beauty to its environment. He was always interested in public affairs, was well informed on political questions, both state and national.

His passing leaves a vacant place in our university group, one that will not soon be filled. As a colleague he will be long remembered for his genial fellowship and fine spirit of cooperation. Many of the younger members of the faculty will recall the cordial interest he showed towards their problems and ambitions. All the older members will preserve the memory of his unfailing friendship.

B. M. DAVIS, *Chairman*
S. R. WILLIAMS
C. H. HANDSCHIN
F. L. CLARK
W. H. SHIDELER

THE THIRD RACE BETTERMENT CONFERENCE

PRELIMINARY announcement of the Third Race Betterment Conference, the first to be held since the war, has been made by Dr. C. C. Little, president of the University of Michigan, who heads the conference committee.

The two-fold object of the forthcoming conference, which will be held at Battle Creek from January 2

to 6, is first to assemble the facts of race degeneracy and also of recent scientific progress dealing with the prolongation of human life, and second to give a greater impetus to the dissemination of these facts for the benefit of humanity. Special group sessions will be given over to reports of recent progress in the field of bacteriology, medicine, nutrition, eugenics, physiology and education.

The conference is being organized under the auspices of the Race Betterment Foundation, the founder and president of which is Dr. John Harvey Kellogg, and which sponsored the first and second conferences held in 1914 and 1915 at Battle Creek and at the Panama Pacific Exposition in San Francisco. The Battle Creek Sanitarium will act as host for the January conference.

Delegates will be present from many research laboratories, including the Rockefeller Institute for Medical Research, the Sheffield Scientific School, the Eugenics Record Office of the Carnegie Institution, Cornell University Medical College, the Universities of Chicago, the Johns Hopkins, Harvard, Yale, Northwestern, Wisconsin, etc.

Among the speakers announced are the following: Miss Grace Abbott, chief of the Children's Bureau, U. S. Department of Labor, Washington, D. C.; Dr. Herman N. Bundesen, city health commissioner, Chicago, president of the American Health Association; Dr. Anton J. Carlson, chairman of the department of physiology of the University of Chicago; Dr. Alexis Carrel, Rockefeller Institute for Medical Research; Professor Russell H. Chittenden, Sheffield Scientific School, Yale University; Dr. C. B. Davenport, Carnegie Institution of Washington, Cold Spring Harbor, N. Y.; the Honorable J. J. Davis, secretary of labor, Washington, D. C.; Dr. Irving Fisher, professor of political economy in Yale University; Dr. Glenn Frank, president of the University of Wisconsin; Professor J. W. Glover, professor of mathematics and insurance in the University of Michigan; Professor M. F. Guyer, professor of zoology in the University of Wisconsin; Dr. Louis I. Harris, New York city health commissioner; Charles Holmes Herty, adviser to the Chemical Foundation, Inc.; Major-General M. W. Ireland, surgeon-general U. S. Army; the Honorable Albert Johnson, chairman of the committee on immigration and naturalization, House of Representatives; Professor E. O. Jordan, chairman of the department of hygiene and bacteriology of the University of Chicago; Professor Charles H. Judd, director of the School of Education, University of Chicago; Dr. Vernon Kellogg, permanent secretary of the National Research Council; Dr. Arthur I. Kendall, dean of the biological department, Northwestern University Medical School; Dr. Franklin H. Martin, director-general of the American College of Surgeons and director of the Gorgas Memorial Institute, Chicago; Dr. Max Mason, president of the University of Chicago; Professor E. V. McCollum, School of Hygiene and Public Health, the Johns Hopkins University; Professor Edward Alsworth Ross, professor of sociology, University of Wisconsin; Dr. Walter Dill Scott, president of Northwestern University; Dr. George David Stewart, president of the American College of Surgeons, New York City; Dr. John Sundwall, professor of hygiene and public health of the University of Michigan; Dr. Aldred Scott Warthin, president of the National Association of American Physicians and director of the pathological laboratory of the University of Michigan, and Dr. Harvey W. Wiley, Washington, D. C.

OPENING OF THE NICHOLS CHEMISTRY BUILDING AT NEW YORK UNIVERSITY

THE Nichols Chemistry Building of New York University was opened on the afternoon of December 3. Dr. William H. Nichols, a graduate of the university, now a member of the council, gave $600,000 for the erection of the building. Among those who gave addresses are Dr. Arthur B. Lamb, professor of chemistry at Harvard University; Dr. Arthur E. Hill, professor of chemistry at New York University, and Dr. James Kendall, professor of chemistry and dean of the graduate school of the university.

Dr. William H. Nichols, a graduate of the university college of arts and pure science of New York University in the class of 1870 and a member of the council of New York University, who in 1925 donated the sum of $600,000 for the erection of the building, and Mrs Nichols were present at the ceremonies. Dr. Nichols formally presented the building and Chancellor Elmer Ellsworth Brown accepted the gift on the part of the university. Mrs. Nichols unveiled the memorial tablet.

The Nichols Chemistry Building greatly enlarges facilities for the teaching and laboratory work in chemistry at the university, which previous to the erection of the new building was carried on in the Havemeyer laboratory, which has now been turned over to the department of biology for research work.

The new building is a rectangular structure 210 feet long by 60 feet wide, located on the south side of the fifty-acre campus at University Heights. It is so constructed as to have four stories and a basement above ground, with an attic for mechanical installation purposes. It contains approximately 1,000,000 cubic feet of floor space and over 60,000 square feet is being devoted to laboratories and lecture rooms.

The building, designed by Augustus N. Allen, is one of the largest buildings in the country entirely

devoted to the study of chemistry. It contains space for large chemical engineering laboratories, which have been fitted up with apparatus for teaching the unit processes in chemical industries. Provision has also been made for laboratories for undergraduate study in organic, inorganic, quantitative and qualitative analysis and physical chemistry. These laboratories will accommodate about 1,300 undergraduate students.

In addition to the laboratories there are three large lecture rooms, an auditorium seating over two hundred and fifty people and four classrooms. The fourth floor is given over to research laboratories for members of the faculty and graduate students. There are in all twenty-five laboratories in the building and each can adequately accommodate several investigators. The Loeb library of chemistry is on the fourth floor. This library was founded by the late Solomon Loeb, of the banking firm of Kuhn-Loeb and Company.

SCIENTIFIC NOTES AND NEWS

DR. IRVING LANGMUIR, of the General Electric Company, Schenectady, N. Y., has been awarded the Perkin Medal for 1928. The presentation will be made on January 13.

DR. ARTHUR H. COMPTON, professor of physics at the University of Chicago, who was recently named as cowinner of the 1927 Nobel prize in physics, has left Chicago for Stockholm, where he will receive the prize on December 10, and will deliver the Nobel lecture on "X-Rays as a Branch of Optics." He will return to the university on January 1 to resume his work. On November 28 Professor Compton was the guest of honor at a dinner and celebration at the College of Wooster, from which he graduated in 1913. Professor Dayton C. Miller, of the Case School of Applied Science, Cleveland, Ohio, was the representative of the American Association for the Advancement of Science at this celebration.

THE honorary degree of doctor of science was conferred on M. Paul Painlevé, professor of analytical and celestial mechanics at the Sorbonne and French Minister for War, by the University of Cambridge on November 16. In the afternoon of the same day M. Painlevé lectured in the Arts Schools on "Resistances d'un liquide au mouvement d'un solide."

THE following is a list of those elected to the council of the Royal Society at the anniversary meeting on November 30: *President,* Sir Ernest Rutherford; *treasurer,* Sir David Prain; *secretaries,* Mr. J. H. Jeans and Dr. H. H. Dale; *foreign secretary,* Sir Richard Glazebrook; *other members of council,* Dr. E. D. Adrian, Sir Hugh Anderson, Dr. F. W. Aston, Dr. F. A. Bather, Sir Archibald Garrod, Sir Thomas Heath, Professor A. Lapworth, Professor J. C. G. Ledingham, Professor F. A. Lindemann, Mr. J. E. Littlewood, Mr. C. Tate Regan, Professor A. C. Seward, Professor G. Eliot Smith, Dr. T. E. Stanton, Sir Gilbert Walker, Sir James Walker.

AT a meeting of Delta Omega, the national honorary public health society, on October 19, C.-E. A. Winslow, Anna M. R. Lauder professor of public health at Yale University, was elected president. Major Edgar E. Hume, U. S. Army, vice-president, and Dr. James A. Tobey, New York, secretary. Chapters of the society have been established at the Johns Hopkins University School of Hygiene and Public Health, the Harvard University School of Public Health, the National Institute of Technology, Yale University School of Medicine, the University of Michigan and the University of California.

DR. F. BAKER has been appointed honorary curator of mollusks at the Scripps Institution of Oceanography, La Jolla.

DEAN JOHN N. COBB, of the University of Washington College of Fisheries, has been appointed to the economic division of the United States Fisheries Association.

DR. H. E. BARNARD has resigned as president of the American Institute of Baking.

THE portrait of Professor J. A. Fleming was presented to University College, London, on November 30. Professor Fleming was also presented with a copy of the portrait, and he has intimated his intention of presenting this copy to the British Institution of Electrical Engineers.

PROFESSOR R. B. WILD, who retired in September from the Leech chair of materia medica and therapeutics in the University of Manchester, was presented on November 11 with his portrait and other gifts. The presentation was made by Professor G. R. Murray, on behalf of Professor Wild's past and present colleagues in the faculty of medicine, in appreciation of the valuable services he has rendered to the cause of medicine and education in Manchester. In accepting the gifts Professor Wild expressed a desire that the portrait should be given to the university, and the vice-chancellor accepted the offer.

THE resignation of Professor E. C. Williams from the Ramsay chair of chemical engineering, tenable at University College, London, has been accepted as from the end of the present academic year.

DR. JAMES M. ANDERS celebrated his fiftieth anniversary in the medical profession on November 28, when he was honored by his friends at a testimonial dinner in the Bellevue-Stratford Hotel. Dr. Josiah H.

Penniman, provost of the University of Pennsylvania, presided. A life-size bust of Dr. Anders was presented to him by Dr. John B. Deaver. At the dinner the speakers were Dr. George L. Omwake, president of Ursinus College; Dr. Judson Daland, professor of medicine in the graduate school of the University of Pennsylvania; Dr. Llewellyn Barker, emeritus professor of medicine at the Johns Hopkins University; Dr. Hobart A. Hare, professor of therapeutics, materia medica and diagnosis at Jefferson Medical College; Dr. David Riesman, professor of clinical medicine at the University of Pennsylvania, and Franklin Spencer Edmonds, who represented the legal profession.

DR. LOUIS F. JERMAIN, dean emeritus, director and professor of the department of internal medicine, Marquette University School of Medicine, Milwaukee, was recently honored at a testimonial dinner given by the faculty and students, and by the bestowal of a golden key commemorating his years of service to the university. The address on this occasion was made by Dr. Eben J. Carey, acting dean and professor in the department of anatomy.

DR. THOMAS BARBOUR, who was recently appointed director of the Harvard University Museum, has resigned as president of the Boston Society of Natural History.

BECAUSE it will be impossible for him to be in attendance throughout the week of the approaching Nashville meeting, Dr. Roger Adams, of the University of Illinois, has resigned from the committee on award of the Nashville prize of the American Association. (See SCIENCE for November 25, 1927, page 511.) Dr. G. Canby Robinson, dean of the Medical School of Vanderbilt University, has been named to fill the vacancy. The committee consequently consists of William H. Roever, William Duane, G. Canby Robinson, Charles Schuchert and Robert J. Terry.

DR. W. C. AUSTIN has recently been appointed a research associate in the sugar section of the U. S. Bureau of Standards, having been granted a fellowship by the Medical Fellowship Board of the National Research Council.

DR. ROBERT F. MEHL has been appointed director of the Naval Research Laboratory.

DR. ROBERT J. PIERSOL, formerly research physicist with the Westinghouse Engineering and Manufacturing Company, is now a consulting physicist with offices in Pittsburgh.

DR. JOHN PHILLIPS, formerly director of the Forest Research Station at Deepwalls, Knysna, South Africa, has accepted the post of senior botanist under the Colonial Office of the Imperial Government to assist in the research on the tsetse fly carried on under the direction of Mr. C. F. M. Swinnerton in the Tanganyika Territory. His work will be to study ecologically the habits and habitats of the various species of *Glossina,* in relation to methods of combating the tsetse fly. After the middle of December he will be at the Department of Game Preservation, Kondoa-Irangi, Tanganyika Territory, Africa.

ROBIN JOHN TILLYARD, entomologist and chief of the biological department of the Cawthron Institute, Nelson, N. Z., has been appointed to take charge of entomological investigations under the Australian Council of Scientific Research.

DR. E. C. WILLIAMS, professor of chemical engineering in University College, London, has been appointed to establish a research organization in California for the Dutch-Shell oil interests.

IN connection with his studies of the flora of Central America, Paul C. Standley, associate curator of plants at the U. S. National Museum, left New York for Honduras, on November 26, for the purpose of conducting botanical exploration in that country for a period of about four months.

DR. I. F. MOLL, of Berlin, recently spent a week studying the collection of shipworms in the U. S. National Museum prior to preparing a monograph on the structure of the pallets of the group.

PROFESSOR OTTO AICHEL, head of the department of anthropology at the University of Kiel, has undertaken a research expedition to Chile. Later he will go to Peru and Bolivia.

ARTHUR S. VERNAY, who with Colonel J. C. Faunthorpe has provided a rare series of specimens of Indian mammals for the American Museum of Natural History, sailed on November 24 on another expedition in the interest of the museum. With him is Albert E. Butler, of the museum's department of preparation, and Clarence S. Rosenkranz, artist.

DR. MICHAEL S. NAVASHIN, of the Timiriasev Federal Institute of Scientific Research, recently arrived at Berkeley, California, where he will spend a year at the University of California. He will work in the genetics laboratories on the cytology of Crepis species and interspecific hybrids. Dr. Jens C. Clausen, of the Royal Veterinary and Agricultural College of Copenhagen, has also arrived at Berkeley, where he will work for several months in the laboratories of the division of genetics on Viola and Crepis. Dr. Clausen has a fellowship under the International Education Board.

DR. PHILIP B. HAWK, president of the Food Research Laboratories, Inc., New York City, sailed for

Norway on December 1 to conduct a scientific survey of the methods involved in the production of Norwegian cod-liver oil. He will remain abroad about four months.

E. L. WALKER, professor of tropical medicine at the University of California, has been transferred from San Francisco to Honolulu until April 30, 1928, for his study of the isolation of the leprosy bacillus at the Kahlili Leprosy Investigation Station at Honolulu.

LEAVE of absence has been given to Dr. Andrew Watson Sellards, assistant professor of tropical medicine at the Harvard Medical School, for the academic year 1927–28. Dr. Sellards will travel to West Africa to make a study of yellow fever and other tropical diseases.

DR. A. HRDLIČKA, of the U. S. National Museum, returned on November 18 from a trip through Europe in the interests of anthropology. The particular object of the journey was to see the most recent discoveries concerning ancient man in Europe. The trip extended through France, Belgium, Germany and Czechoslovakia and ended in England, where Dr. Hrdlička delivered the Huxley lecture before the Royal Anthropological Society on November 8.

DR. J. C. HEYMANS, professor of pharmacology, University of Ghent, Belgium, addressed the University of Wisconsin Medical Society on November 14 on "Contributions to the Physiology and Pharmacology of the Vagus and Respiratory Centers."

DR. SVEN INGVAR, docent in neurology, University of Lund, Sweden, lectured on November 16 and 17 at the University of Chicago clinic, under the joint auspices of the Institute of Medicine of Chicago and the department of neurology of the university, on "The Cerebellum: Anatomic and Clinical Studies."

DR. NORMAN R. STOLL, of the Rockefeller Institute for Medical Research, Princeton laboratories, addressed the class of medical zoology and tropical medicine at the Harvard School of Public Health, on November 23, on the subject "Recent Methods for Determining the Presence and the Intensity of Helminth Infections."

PROFESSOR A. W. C. MENZIES, of Princeton University, will lecture before the Royal Canadian Institute in Toronto on December 10. His subject will be "Atoms and how they combine."

ON November 22 Sir William Bragg delivered the first of a course of four lectures at the Royal Institution on "A Year's Work in X-Ray Crystal Analysis."

THE tercentenary of the publication of Harvey's epoch-making book, "De Motu Cordis," will be celebrated in London under the auspices of the Royal College of Physicians, from May 14 to May 18. Invitations are now being issued, and it is expected that delegates from foreign countries will then gather in London to offer their tribute to the memory of the great physiologist.

A LIFE-SIZED bronze statue of the late Dr. John A. Brashear, maker of telescopes and astronomical instruments and founder of the new Allegheny Observatory, has been placed in the rotunda of the observatory and was unveiled on November 24, the anniversary of his eighty-seventh birthday. The statue is the work of the sculptor Mr. Frank Vittor, and is a gift to the University of Pittsburgh from a number of Dr. Brashear's life-long friends.

DR. HENRY C. WHITE, professor of chemistry at the University of Georgia, has died, aged seventy-nine years.

DR. D. G. HOGARTH, keeper of the Ashmolean Museum, Oxford, and president of the Royal Geographical Society, died on November 6, aged sixty-five years.

THE eighth annual meeting of the Southwestern division of the American Association for the Advancement of Science will be held at Flagstaff, Arizona, from April 23 to 26, 1928. A committee on local arrangements has been appointed as follows: Dr. Grady Gammage, president of the Northern Arizona State Teachers' College, *chairman;* Dr. V. M. Slipher; Dr. H. S. Colton; E. C. Slipher; G. A. Pearson; C. O. Lampland; C. F. Deaver; E. M. Mercer; Dr. M. G. Fronske, and Dr. Chas. Ploussard. The following committee will have charge of the program for the meeting: Professor William G. McGinnies, University of Arizona, *chairman;* J. J. Thornber; C. O. Lampland; R. S. Rockwood; D. W. Rockey; Samuel Burkhard; Dr. Byron Cummings; Odd S. Halspeth, and Dr. Elliot C. Prentiss. A special joint meeting will be held with the Pacific division at Pomona College in June. The division has been invited to hold a similar special meeting with the Southwestern division at Flagstaff.

THE twenty-second annual meeting of the Entomological Society of America is to be held at Nashville on December 27 and 28. In addition to the usual papers the society is planning to have a comprehensive exhibit, including photographs, drawings, apparatus, uniques and other material of technical or general interest. The opening session of December 27 will include a symposium on the physiology of insects. In the evening H. T. Fernald, of the Massachusetts Agricultural College, will deliver the annual public address. A second business meeting will be held the

ollowing day, at which officers for the coming year ill be elected.

ACCORDING to the *Indicator*, a new organization, omposed primarily of the faculty members of the ockefeller Institute and Columbia University, as well s of members of various other local research labratories who are interested in physical and organic hemistry, met on November 17. Following a dinner t John Jay Hall, Columbia University, a scientific ession was held in Havemeyer Hall. Professor T. C. aylor read a paper on "Minor Constituents of the tarch Molecule and their influence on the Properties f Starch." Professor L. P. Hammett gave a paper n "Some Properties of Electrodes." About ninety eople were in attendance and a lively discussion followed. The purpose of this organization is to furnish n opportunity for those chemists residing in New ork and vicinity, who are interested in the more acaemic phases of chemical research, to become better cquainted with each other and to report informally pon researches which they are conducting. No forhal organization has yet been effected, but the general onsensus of opinion was that meetings patterned after hose of the Society for Experimental Biology and edicine would be most desirable. In the meantime, r. D. A. MacInnes, of the Rockefeller Institute, and rofessor V. K. LaMer, of Columbia University, are cting as temporary officers. Professor A. E. Hill as invited the club to the new chemical building at niversity Heights for the next meeting to be held on ecember 15.

FREE lectures and demonstrations will be given at he New York Botanical Garden on Saturdays at 3 . M. as follows: December 3, "Air-Plants," Dr. H. . Gleason; December 10, "Winter Birds in the Boanical Garden," Mr. R. S. Williams; December 17, Ferns," Dr. Marshall A. Howe; January 14, "Auslian and South African Flowers," Mr. Kenneth R. oynton; January 21, "House Plants and their are," Mr. H. W. Becker; January 28, "Planting lower Seeds," Mr. George Friedhof.

THE United States Civil Service Commission anounces an open competitive examination for junior hysicist, applications for which must be on file not ter than December 30. The examination is to fill acancies in the United States Naval Research Labratory, Bellevue, D. C., in the Bureau of Standards, epartment of Commerce, and in positions requiring imilar qualifications. The entrance salary in the Disriet of Columbia is $1,860 a year.

AN engineering tour in Europe has been announced y James A. Moyer, president of the National Uniersity Extension Association and director of the Massachusetts University Extension, according to *The Christian Science Monitor*. The tour has been arranged by several member institutions of the National University Extension Association and was planned for the benefit of factory and public utility executives, instructors and students in engineering schools and others interested in international industrial conditions. Professor N. C. Miller, director of university extension at Rutgers University, and Professor J. O. Keller, director of engineering extension at Pennsylvania State College, with Mr. Moyer are in charge of arrangements. Forty-two days will elapse during the proposed itinerary from the embarkation on the *Tuscania* at New York on July 14, until the return arrival of the *Berengaria* on August 24.

ACCORDING to the *Proceedings* of the Washington Academy of Science the grasses collected on the South Atlantic expedition, 1923–1926, of the Cleveland Museum of Natural History, exploring schooner *Blossom* under the command of George Finlay Simmons, have been sent to the Grass Herbarium of the U. S. National Museum for study. Except for a few from Senegal the grasses were collected on islands on both sides of the Atlantic. While the collection is not large there are many species not before recorded from Ascension, St. Helena, South Trinidad, Fernando Naronha and Cape Verde group. A complete set is deposited in the Grass Herbarium.

CALEB C. DULA, of the board of directors of the Boyce Thompson Institute for Plant Research, has made a gift to the institute of a photographic laboratory to be equipped as completely as possible for the recording of scientific work. Ultra-violet photography, color work, micro-photography, moving pictures, new devices for photographing roots of plants in water with specially devised reflectors, are among the specialized equipment already planned. Besides the recording of the results of experimental greenhouse and field work in all its stages and the making of lantern slides for educational work, much attention will be given to the development of technic with special reference to making scientific records of plant life. Louis P. Flory, formerly of Cornell University, will be in charge of the laboratory.

THE Copper and Brass Research Association has given $2,500, to be added to the metals research fund in the department of physiology at Columbia University.

DR. ELLICE MCDONALD, of the University of Pennsylvania, has received a gift of fifty thousand dollars to continue his researches into the causation of cancer. This gift has been taken to the graduate school of medicine of the University of Pennsylvania where it will be administered under a committee consisting of

Dr. Ellice McDonald, *chairman,* Professor William Seifriz, of the department of botany, and Dean George H. Meeker, of the graduate school of medicine. The plan of research is the study of the physico-chemical aspects of cancer and will have associated with it a number of non-medical chemists and physicists. Three scholarships in research will be open in the graduate school for workers familiar with the colloidal aspects of blood such as cataphoresis, particle size determination, tissue cultures, etc.

ANNOUNCEMENT has been made of the gift to the state of Massachusetts of a new wild life sanctuary of 125 acres adjoining the East Sandwich Bird Farm, by the associated committees for Wild Life Conservation, made up of representatives of the Federation at the Bird Clubs of New England, the Massachusetts Audubon Society and the Massachusetts Fish and Game Association. A fresh-water stream, which separates the new sanctuary from the bird farm, will later be dammed up to make a fresh-water pond on the edge of a salt marsh, which has a variety of cover frequented by many species of song and insectivorous birds, as well as game birds. A small portion of the land is now occupied with pens for the breeding of bob-whites. The property borders on Scorton Creek and Mill Stream and will provide the first public fishing ground that has ever been especially established in the state.

AT the British Embassy in London on November 18 the ambassador presented the vice-minister for communications, representing the Japanese government, with a new standard mutual inductance made at the National Physical Laboratory and given to Japan by the British government in place of the one destroyed in the earthquake of 1923. Representative scientists and engineers attended the ceremony. Professor Sakurai, president of the National Research Council, in a cordial speech, paid tribute to the constant assistance Japanese science had received from Great Britain for more than half a century.

UNIVERSITY AND EDUCATIONAL NOTES

THE state legislature has appropriated $3,481,541 for carrying on the work of the University of Wisconsin. There is available $50,000 for research on special investigations, $341,220 for university extension, $30,000 for farmers' institutes, $60,000 for agricultural extension, $30,000 for substations, $5,000 for corn borer work, $63,100 for county agricultural representatives, $5,000 for the state soils laboratory, $2,500 for hog cholera serum, $6,950 for tobacco experiments and $5,000 for experiments with truck crops.

ANTIOCH COLLEGE has received a gift of approximately $300,000 for a new science building from Charles F. Kettering, head of the General Motors Corporation research bureau. Construction will be started as soon as possible.

FREDERICK W. VANDERBILT has given $116,666.67 toward the construction and equipment of the Vanderbilt clinic at the Columbia Presbyterian medical center. Harold S. Vanderbilt has given $50,000 toward the construction and equipment of the clinic.

N. B. GUERRANT has resigned his position as associate professor of chemical research at the Oklahoma Agricultural and Mechanical College, to fill a position in the department of animal industry, Alabama Polytechnic Institute, where he is devoting his full time to research in nutrition.

DR. W. H. FELDMAN, assistant professor and assistant in veterinary pathology at the University of Colorado, has resigned to accept a position with the Institute of Medical Research of the Mayo Foundation at Rochester, Minn., and has been succeeded by Dr. Henry L. Morency.

APPOINTMENTS to the department of biology in Union College for the present academic year include Dr. Robert K. Enders, assistant professor of zoology, and Mr. Ralph G. Clausen, instructor in biology.

DR. RALPH T. K. CORNWELL, formerly instructor in organic chemistry at Cornell University, is now at the University of Pittsburgh. Dr. Cornwell spent last year in Europe, studying at the University in Munich, Germany, and with Professor Fritz Pregl, Graz, Austria.

AT the University of Chicago, Dr. Warren C. Johnson has been appointed instructor in general and inorganic chemistry, to succeed Assistant Professor Terry-McCoy, who resigned last March.

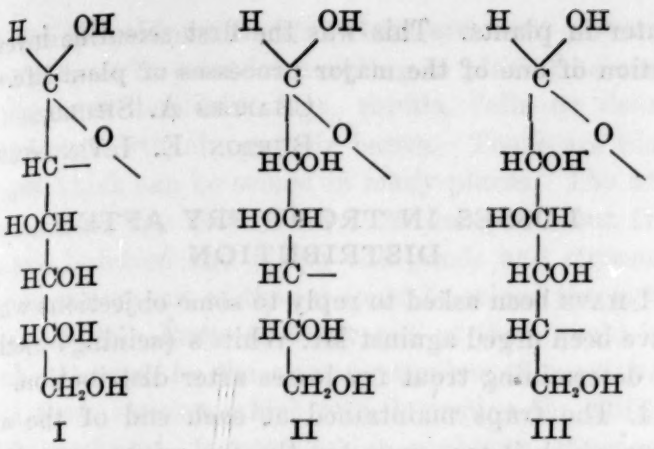
FLOYD S. DAFT, after spending a year of study with Professor S. P. L. Sørensen at Copenhagen, Denmark, as holder of the Cheney Fellowship of Yale University, has been appointed an assistant in the School of Public Health of Harvard University.

DISCUSSION AND CORRESPONDENCE

ON ACTIVE GLUCOSE

IN an address delivered September 6, 1927, before the division of organic chemistry of the American Chemical Society, the thought was developed that the active forms of glucose, *i.e.,* the fermentable forms, are the free radicles resulting from the opening of the oxygen bridges.

This thought had its origin in the observations of Levene and Walti on the behavior of propylene oxide



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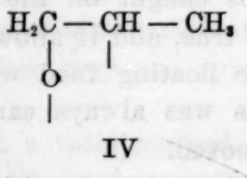
and of glycidol.[1] Each of these two substances shows a greater tendency towards condensation as well as towards intramolecular rearrangement than the corresponding alcohol. Furthermore, optically active propylene oxide was found to undergo Walden Inversion on hydrolysis with acids. This observation was interpreted to mean that in course of the reaction of hydrolysis of the oxide, the free radicle



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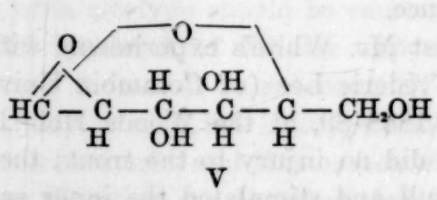
has for a finite, even though infinitesimal, interval of time an independent existence. From this assumption it would naturally follow that the reactivity of an oxide depends upon the stability of the ring structure and indeed <1, 3> and <1, 4> oxides were found more stable than the ethylene oxide structures. In application to sugars, this assumption would mean that those having the ring structure (I) should be more reactive than those with structure (II) and that those with structure (II) should be more reactive than those with structure (III).

Two independent significant communications have recently been published which bear on our theory. Gottschalk[2] has observed that α-glucosan, having the structure



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and containing an ethylene oxidic ring, ferments at a higher velocity than ordinary glucose and Pictet[3] has found that the same glucosan readily condenses with glucose to form maltose. The reactivity of the α-glucosan is explained by our assumption of the formation of a radicle with free valences on carbon atoms (1) and (2). Thus, these communications furnish additional evidence in favor of our assumption.

P. A. LEVENE

THE ROCKEFELLER INSTITUTE,
NEW YORK

[1] Levene, P. A., and Walti, A., *J. Biol. Chem.* 73, 263, 1927; 75, 325, 1927.

[2] Gottschalk, A., *Z. physiol. Chem.* 170, 23, 1927.

[3] Pictet, A., and Vogel, H., Helv. Chim. Acta 10, 588, 1927.

THE STEPHEN HALES PRIZE FUND OF THE AMERICAN SOCIETY OF PLANT PHYSIOLOGISTS

THE year now ending is the two hundred and fiftieth anniversary of the birth of Stephen Hales and it is just two hundred years since the publication of his best known book, "Vegetable Staticks." Now is therefore a most appropriate time to commemorate the life and works of Hales, and the American Society of Plant Physiologists is planning a Stephen Hales session as an attractive feature of its approaching annual meeting in Nashville. At that session will be officially established the Stephen Hales Prize Fund, an endowment fund that is being accumulated in the form of personal subscription by members of the society. The endowment is to be administered as a perpetual trust by the American Society of Plant Physiologists. The income therefrom is to be devoted to prizes in plant physiology, which are to be awarded by the society from time to time. Subscriptions already in hand make it certain that an award of fifty dollars can be made every two years, but the amount of each prize may be increased or the award may become an annual occurrence as soon as such changes become possible. The prize is to be known as the Stephen Hales Prize in Plant Physiology.

The establishment of this prize will certainly mark a definite forward step, it will surely become a milestone in the progress of the botanical aspect of physiological science. In the first place, it will aid in perpetuating the memory of the great pioneer experimenter whose name the prize bears, whose work looms so large in the historical background of plant physiology. Also, the establishment of this prize may tend to emphasize plant physiology as a science, implying its close relation to the other branches of physiology and perhaps offsetting in some degree a noticeable tendency for present writers to allow this particular branch of fundamental knowledge to become indistinct as such, masked or even lost among its numerous and rapidly increasing applications in plant culture and sometimes overshadowed in its basic relations to descriptive morphology and phylogenetic and genetic botany. And the awards themselves may stimulate research

to some extent, and the presentation of the results of research. Furthermore, in inaugurating the Stephen Hales Prize, the Society of Plant Physiologists will provide a means whereby, from time to time, an excellent contribution in plant physiology may be appropriately signalized as exemplary for its period. As the number of papers thus distinguished grows, the younger investigators in this science may turn to them as models. Finally, each award will constitute a democratic expression of approval and appreciation by the colleagues of the investigator thus honored, and the honor of being selected for the Stephen Hales Prize will surely come to be highly valued. Such considerations as these are in the minds of those who are taking part in this cooperative project.

Persons who desire to take part in the foundation of the Stephen Hales Prize Fund should send contributions at once to Professor Charles A. Shull, Department of Botany, The University of Chicago, making checks payable to American Society of Plant Physiologists, Hales Fund. Contributions of any size will be accepted and greatly appreciated by the society. To make the best showing in the records it is highly desirable that a very large number of American plant physiologists should take part in this foundation.

The name of Stephen Hales occupies a very important place in the history of plant physiology, but his was a mind of very broad interests and he made great contributions in many other fields as well. His earliest botanical studies were made afield, in the region about Cambridge, where he collected specimens and catalogued them with the aid of Ray's *Catalogus plantarum*. He was elected to the Royal Society of London at the age of forty and soon made his first communication to that society, on the effects of the sun's warmth in raising the sap in trees. Encouraged by the great appreciation with which this contribution was received, he continued his experimental work along this line and ten years later published his famous book on "Vegetable Staticks."

Hales was curate of Teddington, near London, from 1708 until his death in 1761, at the age of eighty-four. He was interested in nearly all phases of the science of his time. He made the first important contributions to our knowledge of blood pressure and won the Copley medal for studies on bladder and kidney stones. He turned his inventive genius toward practical problems of human welfare. Among his inventions were ventilating devices for use in mines, hospitals, prisons, ship holds, granaries and the like. In his later years he became interested in the ventilation of heated melon frames and greenhouses.

Among students of plant physiology Stephen Hales will always be known especially for his ten years of experimental study of the intake and movement of water in plants. This was the first scientific investigation of one of the major processes of plant life.

CHARLES A. SHULL,
BURTON E. LIVINGSTON

LOSSES IN TROUT FRY AFTER DISTRIBUTION

I HAVE been asked to reply to some objections which have been urged against Mr. White's (seining) method of determining trout fry losses after distribution.

1. The traps maintained at each end of the area over which it was expected the fry might spread evidently gave them ample range. For example, the upper boundary on Forbes' brook was an impassable mill dam; the lower boundary was a wire screen and trap which caught only one hundred and two fry, and this trap was located only thirty-three rods below where the main body of fry (4,020) were deposited. *Fry have a tendency to stay near the point of planting.*

2. That débris is caught on the upper boundary screen is perfectly true, and if allowed to accumulate would obstruct the floating food which comes down stream; but débris was always carefully, regularly and frequently removed.

3. "Fry play hide and seek with the seiners and are often, after the seining is over, counted as dead when they are in reality only hiding."

There is not the slightest doubt that the percentage of missing fry (71 per cent. to 100 per cent.) quoted in White's reports can always be obtained in the vicinity of many places where fry had been planted by dumping them in large numbers. Now that the folly of this practice has been exposed, and that distribution is taking the place of dumping, there may be an increase of survivals.

4. No injury was inflicted upon the fry or fingerlings while they were confined in the observation compartments—either small or large—on Forbes' brook. They were on shorter rations, of course, but this must be a common experience in fish life, if not an everyday occurrence.

5. Contrast Mr. White's experiments with those of Professor Frederic Lee (of Columbia University) on dog fish in 1888–89, at the Woods Hole laboratory. The former did no injury to the trout; the latter cut open the skull and stimulated the inner ear in order to demonstrate the functions. (And he was justified in doing so.) In this injured condition the dog fish were kept alive for days at a time. Yet no scientist ever objected to the validity of Lee's conclusions. Indeed, if the objections to White's seining experiments are held to invalidate his investigations then a vast amount of outstanding research in experimental zoology and physiology by some of the best biologists in America will have to be discarded.

6. Granted, of course, that there are many streams which can not be seined (excepting in places) because of numerous boulders, logs, rapids, falls or dense vegetable growth along their banks. There are also streams which can be seined in many places. The fish commissioner for Ontario in 1925 dumped trout fry into two hundred and ninety-one ponds and streams. Not one stream out of the lot could be seined throughout its length. Parts of every one of them could be seined. It must be the average number of surviving fry in these streams which will determine the utility of fish hatching. In engineering problems, averages must be relied upon, otherwise estimates of cost would be pure guess work. There need be no guess work in approximating the losses in trout fry, if only the seining is carefully and repeatedly done.

The people of Canada and the United States have in the past sixty years spent millions of dollars upon fish culture. They have, therefore, a right to know the approximate average cost of the artificial propagation of fry, fingerlings and adult trout in any given year. And they have also a right to know what becomes of them after they are spread in lakes and streams.

If seining is not a valid method, perhaps some of the fish culturists will suggest a better one and furnish the public with a description of its working and a statement of the losses which it uncovers. The fish culturists are spending the money. It is their duty to show that fish rearing is worth the money which is being spent upon it.

Any sensible man with a government at his back can run hatcheries and distribute fry, especially if there is to be no accounting for dead fry, and if in effect no instruction is given to the superintendent except: "Turn out fry and damn the cost."

A. P. KNIGHT
KINGSTON, ONTARIO, CANADA

THE USE OF THE TERM ALLOTYPE

THERE seems to be a diversity of opinion as to whether the term allotype should be employed for the first described specimen of the sex opposite to that of the holotype in case it is subsequently described. In the last analysis only the holotype can fix application of a specific name, and it is an academic matter as to whether the other sex be associated at the time of the original description or later. If there has been an error in associating the supposed sexes, the one will be just as incorrectly considered part of the species represented by the holotype if described with it, as though described a century later. Nevertheless, it is important to have the specimen from which the description of the second sex was taken, distinguished in some way, even though the fate of no name may hang thereon; for it is desirable at times to have a source from which the exact meaning of an author can be determined for other than nomenclatorial reasons. Without multiplying terms, allotype should suffice. If the allotype is described with the holotype it is also a paratype and has no more nomenclatorial significance than any other paratype, probably less value than a paratype of the sex of the holotype for there is greater likelihood of its actually representing a different species. If the allotype is described subsequently to the holotype it is not a paratype, and that is sufficient distinction.

R. A. Muttkowski (Milwaukee Publ. Mus., Bull. 1, p. 10, 1910) first proposed the term allotype. His original definition of it is quite in accord with my understanding of its proper use and does not sanction its restriction to paratype. It reads: "*Allotype*—('αλλσς—other) for the sex not designated by the holotype. The allotype need not be described by the protologist (first describer); it can be contained in the original as well as any subsequent description by other authors. Thus if the protolog describes only a holotype male, the first female subsequently described is to be called the allotype."

J. C. BRADLEY
CORNELL UNIVERSITY

CONSIDER THE USER OF BULLETINS

FEDERAL and state experiment station publications of various types constitute one of the principal reservoirs of stored knowledge regarding agricultural arts and sciences. They are the most common form of original record of experiment or research related to agriculture and, as such, become important tools for all professional workers in both agricultural and related biological lines. Lacking ready access to them the teacher and the experimenter find themselves seriously handicapped in their efforts.

Because of their constant and frequent use, most of these workers maintain private files of such station publications as relate to their specific subdivision of agriculture and quickly discover that, because of their great and ever-increasing numbers, some system of cataloguing is necessary to render ready reference possible. Two common bases for cataloguing of this type are in use: (1) the title or subject-matter of the publication, and (2) the name of the author. Arguments favoring either of these bases could be advanced but whichever is chosen the name of the author is nearly always recorded on the catalogue card. It is nearly as important to the user of the publication as is the title itself. It sometimes carries more definite information.

All such bulletins display the title of the discussion on either a cover page or in a table of contents, but many of them fail to show the name of the author in these or similarly conspicuous places. Because of this oversight or poor form of publication the cataloguer has to search through several pages of the bulletin or report to discover the name of the author, thus greatly prolonging a disagreeable but necessary task.

The practicability of a form showing the name of the author on the cover page or title page, or in the table of contents if a number of articles were bound together, is assured by its being common usage in many stations. Others display the name of the author in a prominent position on technical publications, but conceal it if the treatment is of a more popular nature. Study of recent publications from 20 stations shows 9 which display the name of the author, 2 which always hide it, 7 which vary with the type of the publication, and 2 which are inconsistent in this feature.

Just a simple change in form by some of the station editors would make the use of their publications much more convenient to such workers as catalogue them, and no others can use them to the best advantage.

R. J. BARNETT

KANSAS AGRICULTURAL
EXPERIMENTAL STATION

SCIENTIFIC BOOKS

Catalogue of Cainozoic Plants in the Department of Geology, vol. I. The Bembridge Flora. By ELEANOR MARY REID and MARJORIE ELIZABETH JANE CHANDLER (with a section on the Charophyta by James Groves), 206 pp., 12 pls. British Museum (Nat. Hist.), London, 1926.

ALTHOUGH it is some months since copies of this work reached this country, I have seen no reviews of it, and such a scholarly work deserves being brought to the attention of a much larger group of botanists and geologists than are otherwise likely to be aware of its existence.

It is something of a paleobotanical event for the British Museum to start a catalogue of Tertiary floras, particularly since the floras of the earlier half of the Tertiary are abundantly represented in the south of England, and these have never been made available for students, in fact, practically no work has been done on them since J. Starkie Gardner stopped in the midst of his labors in 1886. Since that time, as both the authors and Dr. Bather point out, geology has advanced, improved methods of study have been devised, and, perhaps most important of all, botanical exploration, especially in southeastern Asia, has made available a wealth of new comparative material.

The present volume is devoted to the fossil plants of the Bembridge beds of the Isle of Wight, of Oligocene age. This flora is represented by foliar remains, usually fragmentary, and by a large variety of fruits and seeds. Hence the authors are especially well qualified for this particular type of study. The senior author—Eleanor M. Reid, or Mrs. Clement Reid as the friends of her late husband like to think of her, collaborated with him in his most important contributions to paleobotany; and Marjorie E. J. Chandler, the junior author, already has several important papers along carpological lines to her credit. James Groves, the well-known student of the Charophyta, has contributed descriptions of the 8 species of Chara discovered in these beds.

One hundred and twenty-one species are described, of which 42 are new. Dicotyledons are represented by over half of the total, and there are 24 monocotyledons, 10 conifers, 1 Equisetum, 8 ferns, and 8 charas. Among the more interesting new things are a splendidly preserved species of *Azolla*—the first convincing fossil remains of this type to be discovered: *Hooleya,* a new and extinct genus of the family Juglandaceae: and the demonstration that a number, if not the majority, of the fossil fruits referred to the Compositae under such names as *Cypselites, Bidentites,* etc., are not composites, but belong either to the Apocynaceae or Asclepiadaceae. For these the authors propose the new form genus *Apocynospermum.*

Naturally a flora so largely represented by carpological material is difficult to compare with the classic Oligocene floras of Europe based upon leaf impressions or amber inclusions, so that the authors confine their comparisons to selected floras. Among the results of their systematic study the conclusion emerges that, beginning with the upper Eocene and continuing to the end of the Pliocene, the European flora gradually changed from one mainly East Asian and American—largely by the progressive invasion of the region by genera called European, although the species in these so-called European genera still show most pronounced Asiatic and American affinities. They believe that this change in facies was brought about by a southward dispersal from some circumpolar source. They have some slight evidence (*Chlorophora* in the upper Eocene of Hordle) that in the early Eocene direct connections with Africa were not yet broken. They conclude that the climate denoted by the Bembridge flora was probably warm temperate or sub-tropical, and certainly the presence of such

genera as *Acrostichum* and *Palaeothrinax* point toward such a conclusion, as has long been recognized.

It seems to me that Holarctic would have been a better term than East Asian-American, for certainly the evidence is clear that other parts of Asia shared in the growing cosmopolitanism of the Tertiary floras of the Northern Hemisphere. Furthermore, although in hearty agreement with most of the author's conclusions, I can not believe that the Tertiary floristic history was as simple as it has been visualized. In Provence, at Haering, and elsewhere in Europe, we see plain evidence of immigrants from Africa, and the dispersal of Tertiary mammals offers some corroborative evidence, as well as of repeated westward spreads from Asiatic instead of northern sources.

Here in America the most distinctive elements in the early Tertiary floras appear to me to have been derived from the south, and I believe that the same is true of the warmer climate plants of the English Oligocene. I suspect that we will eventually demonstrate many latitudinal swings back and forth, rather than waves of southward dispersal urged by a single progressive cooling in high latitudes.

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SPECIAL ARTICLES

BLUEBERRY CHROMOSOMES

FOR sixteen years the writer has been making experiments in the hybridization and selection of native American blueberries, species of the genus *Vaccinium*. The practical outcome of these experiments has been the development of valuable horticultural varieties producing berries of very large size. Some of the hybrids now in commercial cultivation, Pioneer, Katharine, Cabot and Rancocas, have yielded berries three-quarters of an inch in diameter, and last year the berries of two unnamed hybrids, 1257A and 1443A, reached a diameter slightly in excess of seven-eighths of an inch.

In the course of these experiments it was found that certain species, some of them very different in general appearance and in technical characters, hybridize readily. Other species, some of them very closely related, are sterile to each other's pollen and yield no hybrids.

The lowbush blueberry, *Vaccinium angustifolium*, of the northeastern United States, hybridizes easily with the highbush blueberry of the same region, *V. corymbosum*. The horticultural variety Greenfield is a second-generation hybrid between these two species, containing two quarter-strains of each. The horticultural variety Rancocas is another second-generation hybrid of the same ancestry, containing one quarter-strain of lowbush blueberry and three quarter-strains of highbush blueberry. Natural hybrids between these two species are of frequent occurrence in New England pastures. The plant named in Gray's Manual *Vaccinium corymbosum amoenum* is one of these natural hybrids.

The dryland blueberry (*Vaccinium vacillans*), the Canada blueberry (*V. canadense*), and the bigbush blueberry (*V. atrococcum*) could not be crossed with either the lowbush or the highbush blueberry. That the highbush and the bigbush blueberry did not hybridize was to me very surprising, for the two species are closely related, so closely indeed that Asa Gray regarded one as a variety of the other.

Two southern species, the hairy blueberry, *Vaccinium hirsutum*, and the myrtle blueberry, *V. myrsinites*, hybridize freely in the greenhouse with both the highbush and the lowbush blueberry, notwithstanding the great structural differences between the species thus hybridized. One, *Vaccinium hirsutum*, a species of the southern mountains, has a bristly-hairy fruit, inconspicuous winter flowering buds, an extraordinarily large stigma, and almost woolly leaves. The other, *V. myrsinites*, a species of the southern coastal plain, has very small evergreen leaves, and hardly looks as though it belonged to the same genus as the highbush and the lowbush blueberry of the north. That these strikingly different southern species hybridize easily with the two northern species surprised me greatly.

Desiring to learn the reason for this curious grouping of blueberry species, with reference to hybridization, I tried for several years to induce some one of the plant cytologists to make a study of blueberry chromosomes, but without success. Cytologists are scarce and busy. At last, through the mediation of G. N. Collins, Dr. A. E. Longley undertook the sport of hunting the blueberry chromosome. He began the work in the spring of 1924 and continued it in the years following, as material became available. Dr. Longley's results up to this time are presented in a paper accompanying this paper of mine.

Dr. Longley has made the discovery, important and significant in blueberry breeding, and fascinating in the facility with which it removes obstacles to this pursuit, that certain species of blueberry have twelve chromosomes, others twenty-four, and still others thirty-six.

The highbush and lowbush blueberry, which hybridize freely, both in nature and artificially, have twenty-four chromosomes. In the dryland blueberry, the Canada blueberry, and the bigbush blueberry, no one of which has hybridized with either the highbush or the lowbush blueberry, the number of chromosomes is twelve.

The question naturally arose whether the 12-chromosome species would not hybridize with each other. It happened that these crosses had never been attempted, because in these three species no plants had been found whose characteristics were desirable for combination. With the new incentive, however, numerous cross-pollinations were made in 1926 between the Canada blueberry and the dryland blueberry and between the dryland blueberry and the bigbush blueberry. Fruit set promptly, the berries contained an abundance of seeds, and the seeds have now produced vigorous young plants, some of them ready to flower next spring.

From still another cross, not yet mentioned, curious results had been obtained. This was a cross, made in 1922, between the rabbiteye blueberry of Florida, *Vaccinium virgatum*, and one of the large-berried northern hybrids. Many of the pollinations failed, but berries containing seeds were obtained in sufficient number to produce several hundred seedlings. They grew with great vigor and flowered freely, but although hundreds of pollinations were made on them with pollen of known virility, not a single well-developed berry resulted, and the occasional small and late berries they bore contained no seed possessing an embryo. In the production of offspring this cross, therefore, has proved completely sterile.

Upon examining the rabbiteye blueberry, Dr. Longley found that this species has thirty-six chromosomes. The plant with which it was crossed has twenty-four chromosomes. The resulting sterile hybrids usually have thirty chromosomes.

Since many who read this paper are doubtless unfamiliar with the action of the chromosomes, the minute bodies that are reputed to carry to the offspring the characteristics about to be inherited from the two parents, the following brief statement is presented regarding them. It represents the ideas current among geneticists. When the first cross-pollination in this series was made, the thirty-six chromosomes from the pollen grain of one parent were poured into the egg cell of the other parent, which already contained twenty-four chromosomes. The total of sixty chromosomes was carried through each cell of the resulting hybrid, in the ordinary process of cell division, until the plant was nearly ready to flower. Then ensued a phenomenon known as the reduction of the chromosomes, in the cells that produce the pollen grains and the egg cells. Presumably twenty-four of the sixty chromosomes, representing those derived from the 24-chromosome parent, combined with twenty-four of the thirty-six chromosomes representing the other parent. The remaining twelve chromosomes from the second parent, having no chromosomes with which to pair normally, paired abnormally with each other or remained unpaired. This abnormal pairing of the chromosomes, according to the current view, caused a derangement of the normal activities of the plant, which resulted in sterility of fruit production.

The rabbiteye blueberry has come into cultivation extensively in the South by the transplanting of the wild bushes. It is of great importance that this species be improved by hybridization. The first attempt to do this failed, seemingly because the rabbiteye blueberry stood alone in the number of its chromosomes. The possibility of improvement appeared to depend on the finding of another species having thirty-six chromosomes, and possessing also desirable characteristics that could be transmitted to a hybrid.

In the higher Appalachian mountains of western North Carolina and eastern Tennessee occurs a native species, *Vaccinium pallidum*, the Blueridge blueberry, which has large, beautiful and delicious fruit. As early as 1911, attempts were made to cross this with the highbush blueberry and the lowbush blueberry, but all the pollinations failed, and the Blueridge blueberry was therefore abandoned as a breeding stock.

In the hope that this blueberry might be a 36-chromosome species, because it had failed to hybridize with the 24-chromosome species, plans were made for the spring of 1927, to determine its chromosome number. Material was obtained from western North Carolina through the courtesy of George E. Murrell, horticulturist of the Southern railway. On critical study of the material Dr. Longley found, to the great delight of all of us, that the Blueridge blueberry has thirty-six chromosomes.

If future experience confirms the view that the number of the chromosomes in blueberry species is a true index of the facility of their interbreeding, as the experiments indicate thus far, we shall be able next spring to hybridize the rabbiteye blueberry with the Blueridge blueberry, and thus add one more item to our knowledge of the means by which wild species become plastic in the hands of science.

FREDERICK V. COVILLE
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CHROMOSOMES IN VACCINIUM

A CYTOLOGICAL investigation of the number of chromosomes in a dozen *Vaccinium* species and hybrids has revealed three diploid, six tetraploid, one pentaploid and two hexaploid forms.

The material used for this study of the chromosomes in microspore-mother-cells was collected early in the springs of 1924, 1925, 1926 and 1927 from *Vaccinium* plants grown under the direction of Dr. Frederick V. Coville at the greenhouses of the Bureau of Plant

Industry, Washington, D. C., and from plants growing in their wild habitats.

Two methods were used in preparing buds for study. In one, the buds were killed with chromo-acetic killing fluid, embedded in paraffin and stained with Haedenhains haematoxylin. In the other, fresh collected buds or buds killed in acetic-absolute (1–3) were stained with aceto-carmine killing and staining fluid. The former more tedious method was very satisfactory and served as a check against the latter quicker method, which was found to give excellent preparations when the difficulty of using aceto-carmine on the minute anthers of *Vaccinium* was overcome.

Diploid Species

Vaccinium atrococcum, wild plant from Aurora Hills, Va.
Vaccinium canadense, wild albino plant (Shear).
Vaccinium canadense, wild plant (La Roche).
Vaccinium vacillans, wild plant from Aurora Hills, Va.
Vaccinium vacillans, wild albino plant from New Jersey (MacIlvaine).

These three species were found to have 12 bivalent chromosomes at diakinesis of the pollen-mother-cell. Since 12 is the lowest number found in any *Vaccinium* species, it seems probable that 12 is the basic number for the genus, and that the three forms listed are true diploid species. This view is substantiated from our study of *Polycodium stamineum* and *Gaylussacia baccata,* representative forms of two closely related genera. The same basic chromosome number, 12, characterizes these two species.

The meiotic phases in the pollen-mother-cells of these three species are passed through in a very regular manner, giving each cell of the tetrad the reduced chromosome number. Text figure 1A shows the chromosomes of *Vaccinium canadense* in the heterotypic prophase. The chromosomes are small compact masses at this phase and show no individual morphological characteristics.

Tetraploid Species

Vaccinium angustifolium, wild plant from Middlesex Fells, Mass.
Vaccinium angustifolium, wild plant (Russell).
Vaccinium corymbosum, wild plant from Lincoln, Mass.
Vaccinium corymbosum, wild plant (Taylor No. 2).
Vaccinium corymbosum, wild plant from North Carolina (Sampson).
Vaccinium hirsutum, wild plant.
Vaccinium corymbosum × *V. corymbosum* (Dunfee × Rubel, plant No. 20 of culture 2300).
Vaccinium angustifolium × *V. hirsutum* (culture 1560).
Vaccinium angustifolium × *V. myrsinites* (culture 1535).
(*Vaccinium angustifolium* × *V. myrsinites*) × *V. corymbosum* (culture 1908).

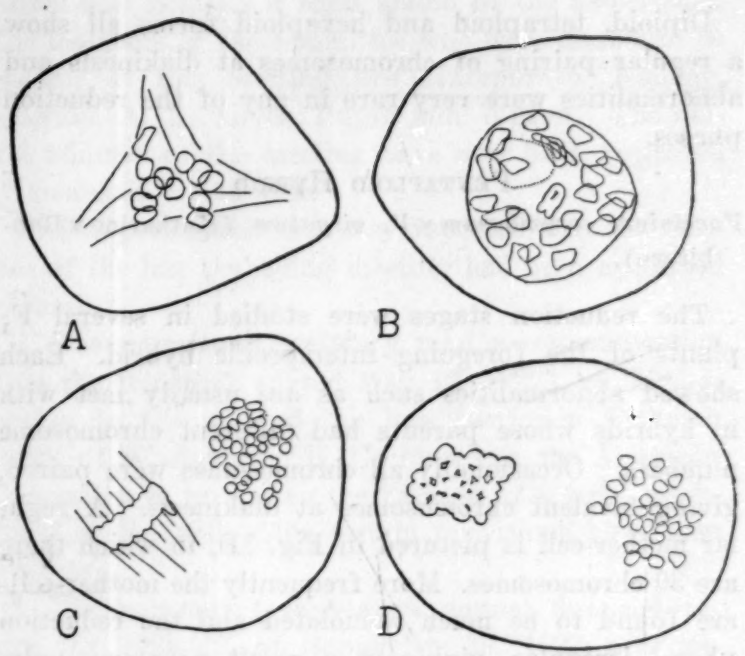

FIG. 1. Microspore-mother-cells of *Vaccinium*: A, heterotypic prophase in *V. canadense,* showing spindle and twelve chromosomes; B, diakinesis in *V. angustifolium,* showing twenty-four bivalent chromosomes; C, homotypic metaphase in *V. pallidum,* side view of left spindle, end view of right spindle, the latter showing thirty-six chromosomes; D, homotypic metaphase in *V. corymbosum* × *V. virgatum,* the plate at the right showing thirty chromosomes. (A, × 800; B, × 800; C, × 600; D, × 500.)

The three species and four hybrids listed above were found to have 24 as the reduced or haploid number of chromosomes.

The increase from 12 to 24 chromosomes made it more difficult to find cells where chromosome counts could be made. Text figure 1B shows the chromosomes at diakinesis in *V. angustifolium* (Russell). The chromosomes show to some extent their paired nature at this stage. A few assume such shapes as opened and closed rings but a detailed study of individual chromosome characters was not attempted.

Hexaploid Species

Vaccinium virgatum, wild plant from Crestview, Florida (culture 1881).
Vaccinium pallidum, wild plant from Pisgah Ridge, North Carolina.

In the spring of 1926 some buds from two plants of *V. virgatum* were procured. In this species 36 haploid chromosomes were found.

The discovery of a hexaploid species led us to extend our search. In the spring of 1927 buds of *V. pallidum* were procured. Our material gave us only a few well-preserved cells in which the chromosome number could be counted. Fig. 1C pictures the homotypic metaphase of *V. pallidum* showing 36 chromosomes.

Diploid, tetraploid and hexaploid forms all show a regular pairing of chromosomes at diakinesis and abnormalities were very rare in any of the reduction phases.

PENTAPLOID HYBRID

Vaccinium corymbosum × *V. virgatum* (Katharine × Rabbiteye).

The reduction stages were studied in several F_1 plants of the foregoing interspecific hybrid. Each showed abnormalities such as are usually met with in hybrids whose parents had different chromosome numbers. Occasionally all chromosomes were paired, giving bivalent chromosomes at diakinesis. A regular mother-cell is pictured in Fig. 1D, in which there are 30 chromosomes. More frequently the mother-cells are found to be much vacuolated and the reduction phases irregular, giving as a result polycary, polyspory and very little normal-appearing pollen.

A. E. LONGLEY

U. S. DEPARTMENT OF AGRICULTURE

THE STRETCHING OF COPPER WIRE

THE following suggestive experiment has been in use in the Physical Laboratory of Queen's University at Kingston, Ont., for some years. As it is thought to embody some novel features it is offered to those who may be interested in it.

A light copper wire is *stretched* horizontally on an ordinary laboratory stand, as shown in Fig. 1. The depression of its mid-point for various loads is observed through a reading microscope. Stress and strain are expressed in terms of the dimensions of the wire, the load and the depression of the mid-point, and, from the plot of one against the other, values are found for Young's modulus, for the stress or strain at the elastic limit, for the yield point and for the stress and the strain *initially* in the wire.

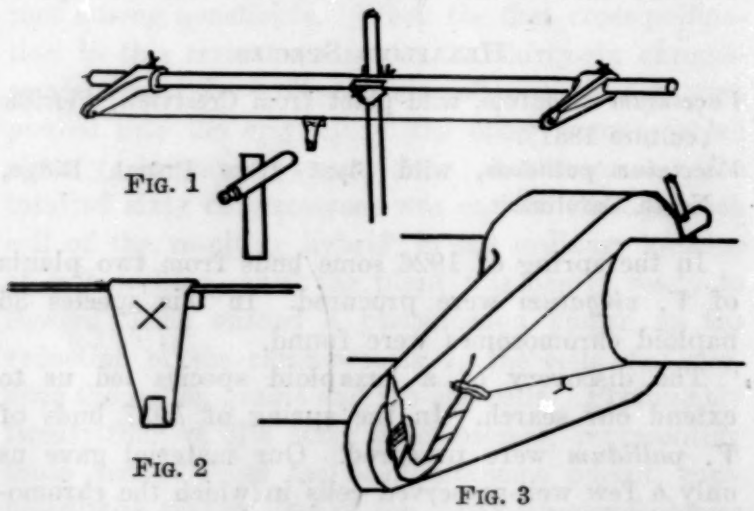

FIG. 1

FIG. 2

FIG. 3

The details are as follows: The most satisfactory grip for the wire ends so far found is made by winding them *tightly* around bent wire nails (See Fig. 3), the wire then passing through the *upper part* of a hole in the bracket arm. A subsidiary wire from the nail head around the horizontal arm holds the nail in place until the wire is stretched by the separation and clamping of the brackets. On the middle of the wire is placed a light hook with a fiducial mark (Fig. 2). The level of the center of this cross is read on

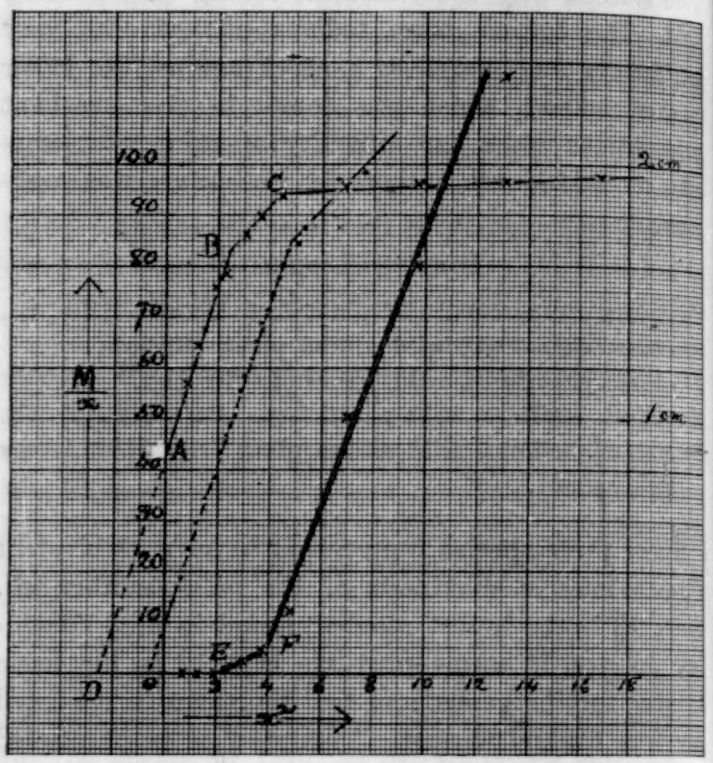

FIG. 4

the microscope scale before any load is applied, after the application of each load and after the load has been removed.

For example: Wire from a spool labelled "Bright H. C. Copper Wire No. 26"

Length of wire = l = 91.9 cm. (nail to nail)

Radius of wire = r = 0.023 cm.

Load M	Level of fiducial mark		Depression	
	Under load	Load removed	Under load	Load removed
gm–wt.	cm.	cm.	cm.	cm.
0.0	.....	9.140	.....	.....
50.6	8.250	9.140	0.890	0.000
70.6	8.040	9.140	1.100	0.000
100.6	7.740	9.135	1.400	0.005
120.6	7.600	9.115	1.540	0.025
150.6	7.390	9.095	1.750	0.045
170.6	7.240	9.050	1.900	0.090
	etc.	etc.	etc.	etc.

Using the simplest of vector diagrams and noting that the angles are small we find that the stress in the wire is given by

$$\frac{M}{x}\left(\frac{gl}{4\pi r^2}\right)$$

independently of the initial stress, and that the strain is given by

$$x^2\left(\frac{4}{1^2}\right)+S$$

where S is the strain produced in the wire by the initial stretching and π is the depression.

Platting $\frac{M}{x}$ against x^2 we get the graph shown in Fig. 4 where the crosses show the values for the table quoted above and the dots show a similar set obtained from another piece of the same wire *but under a much smaller initial strain.*

It will be noted that the slope of the line *A B* multiplied by the ratio of the constants $\left(\frac{g\,l}{4\pi r^2}\right)$ and $\left(\frac{4}{1^2}\right)$ gives Young's modulus for the copper used. *B* is the elastic limit and *C* the "yield point." The variation of the level of the fiducial mark from its original position for each of these points is shown by the double line on the plot (scale to the right hand of plot). It will be observed that the break at *E* corresponds with the elastic limit at *B,* and that *F* (where the large yield occurs) corresponds with *C* on the line of stress and strain.

And finally, if one extends the line *B A* back to cut the axes, $O\,A\times\left(\frac{g\,l}{4\pi r^2}\right)$ gives the initial stress in the wire and $O\,D\times\left(\frac{4}{1^2}\right)$ gives the initial strain.

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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE REGULAR FALL MEETING OF THE EXECUTIVE COMMITTEE

THE regular fall meeting of the executive committee of the American Association was held at the Urbana-Lincoln Hotel, in Urbana, Illinois, on Monday, October 17, 1927. Three sessions were held, each of about two hours, beginning at 10:00, 3:00 and 8:00 o'clock, and the members who were present dined together at 6:15 at the same hotel. The following members were present: Cattell, Fairchild, Livingston, W. A. Noyes and Ward. The following items of business were transacted, with the approval of those present and with the subsequent approval of Dr. Humphreys, who added his vote to the five votes of those who were present at the sessions. Each item of business consequently has the approval of a majority of the committee and becomes a legal action of the association. The members of the committee who were unable to be present at this meeting are Humphreys, Kellogg, Moulton, A. A. Noyes, Pupin and Wilson. The official minutes of the meeting have now been approved by means of a mail vote.

1. The permanent secretary reported that the minutes of the last preceding meeting had been approved by mail.

2. The permanent secretary read a communication from the treasurer (dated May 12, 1927), calling attention to the will of the late Benjamin Pickman Mann, of Washington, D. C., by which the American Association is to receive the balance of a trust established by the will, after certain provisions have been cared for.

3. The permanent secretary's annual financial report for 1926–27, of September 30, 1927, was accepted and referred to the council.

4. The permanent secretary's proposed budget for the fiscal year 1927–28 was unanimously approved. This is based on prospective receipts (entrance fees of new members and annual dues) of $70,000, of which $43,000 is to be expended for journal subscriptions for members (SCIENCE or *The Scientific Monthly*).

5. The permanent secretary's annual report on membership for the fiscal year 1926–27 was accepted. On September 30 the total number of members in good standing was 13,930, representing an increase of 537 since the preceding annual report. The total enrolment (including, besides members in good standing, those whose names were retained on the roll although in arrears for one or for two years) was 14,862, representing an increase, since last year's report, of 496, or 3.4 per cent. New members and reinstatements amounted to 1,327 for the fiscal year just closed. The total loss in enrolment amounted to 831, including 178 deaths, 281 resignations and 372 names dropped October 1, 1926, at the close of two years of arrears. On October 1, 1927, 412 names were dropped from the roll on account of two years of arrearage. The permanent secretary added that 450 new members had been enrolled since September 30, 1927. (This number has now increased, November 14, 1927, to 1,114 and the total enrolment is now 15,572.)

6. The permanent secretary reported that $1,310.00 had been received as contributions from members to the Agassiz Bust Fund (see SCIENCE for December 10, 1926) and that that amount had been paid over to the Hall of Fame, New York University. The expenses of the committee on the Agassiz Bust Fund were $362.33, met from the current funds of the permanent secretary's office and not charged against the fund. This report was approved and the permanent secretary was asked to make arrangements, if possible,